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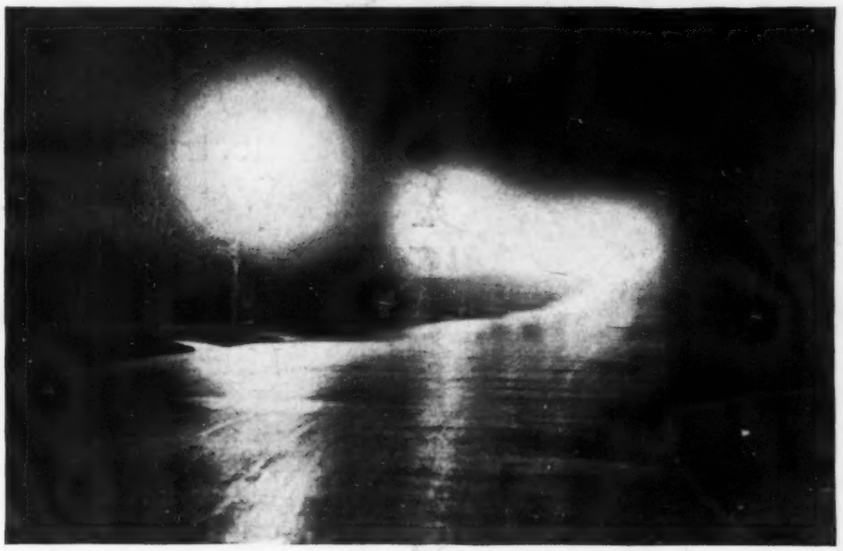

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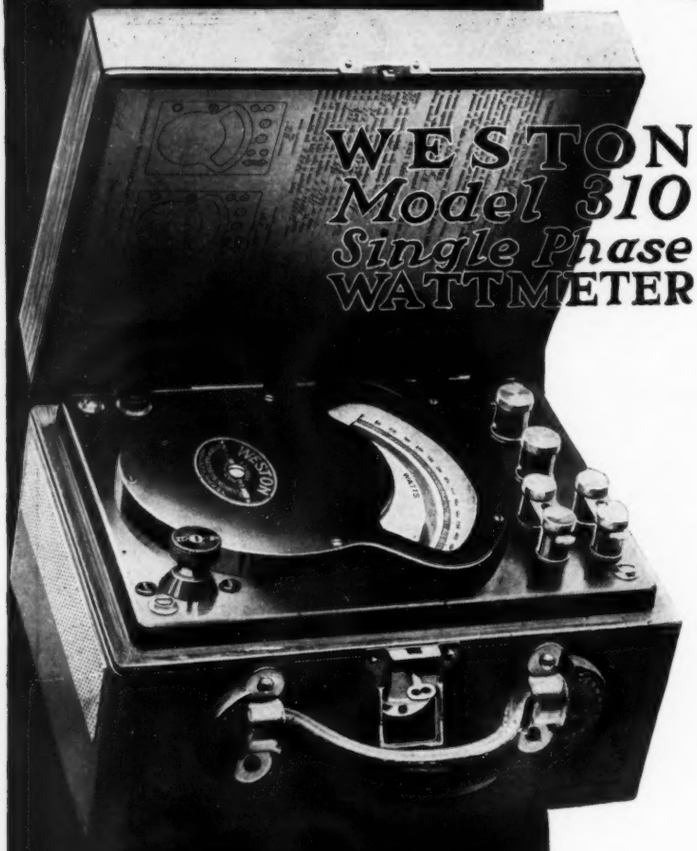

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W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

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Lay Aside the Habiliments of Strife!

IT IS an inspiring thing to see an idea travel and gain speed. There was a time when central-station companies armed themselves against their customers with legal swords and bucklers, laid down barrages of rules and regulations and set up entanglements of red tape, lest any applicant for service should encroach upon the company in some detail. To prevent unfair advantage on the part of the public they entrenched behind the grim ramparts of technicality and tradition and themselves took unfair advantage of the public in ways only possible because they stood in the position of power.

But those days have gone in most cities, and where they linger still their strength is visibly weakening—and it is high time.

Consider, for instance, the process whereby a fair-minded, virtuous citizen makes application to the electric light and power company (that he himself has enfranchised) for service which that corporation has been empowered to render in the public interest. In days gone by that meant a signed application, the payment of a deposit lodged as security, and then a delay to enable the wheels of system to grind out an order that would bring him light. Gradually, step by step, these creaking cogs in the machinery are being pried out and cast away, until the householder moving into a vacant dwelling in a city served by one of our most enlightened companies today finds the service ready waiting for the turn of a switch and a little card dangling from the hall chandelier welcoming him to the service and asking him to notify the office on his arrival.

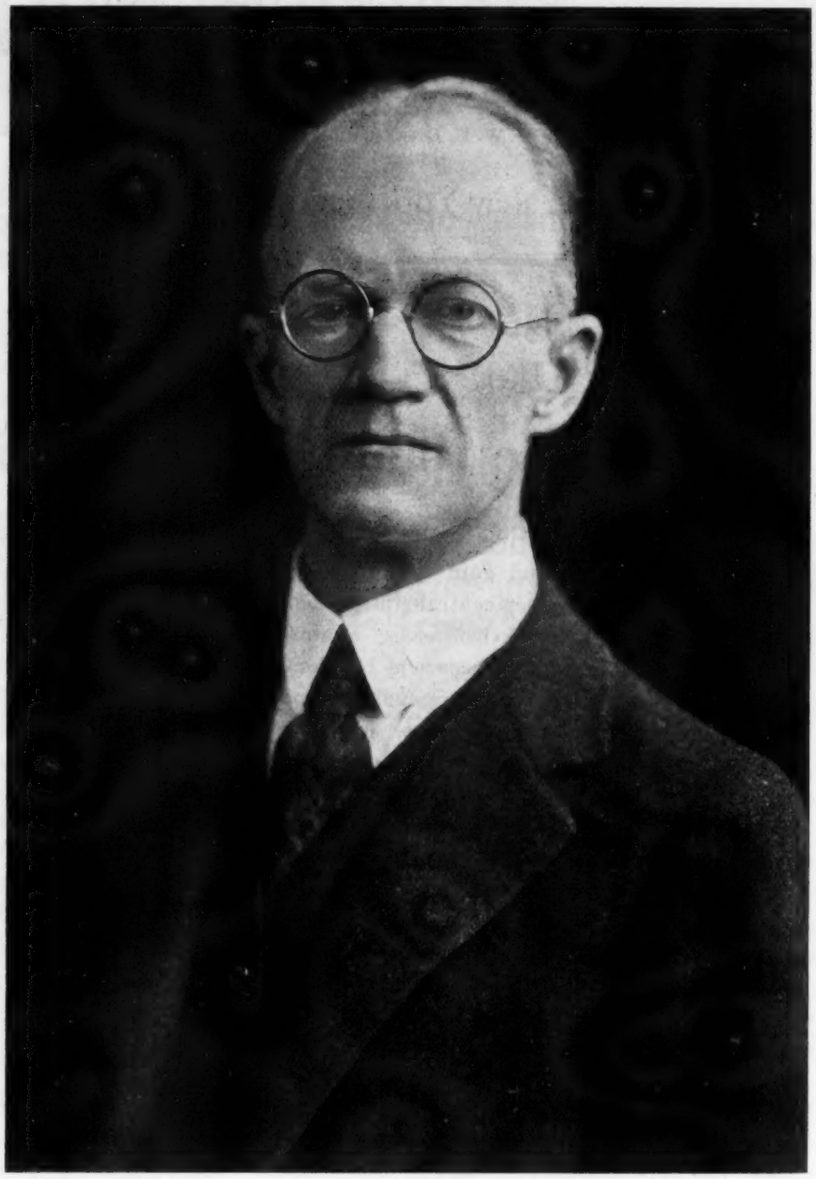
The first utility company that—in defiance of tradition—proposed such a liberal policy of convenience to the public was looked upon by other central-station men as mad. Such free-thinking innovations since time began have been branded as pernicious practices destined to bring the world down about men's ears. But today in Baltimore, Cleveland, Harrisburg, Utica, New Orleans and probably many other cities the current is not turned off at all when homes become vacant. In New York, Syracuse and doubtless many more communities the meter is left in, that the new tenant may not be delayed when he arrives and wishes light.

It is only a matter of viewpoint after all—part of the slow transition from an intolerant state of mind, where all men assumed that the other fellow would impose on them if he had the chance, to a general acceptance of the oft-proved fact that most folks are honest and disposed to be fair. However, it is good business, since the cost of unbilled energy is far less than the cost of reconnections. All this but for example.

The world is moving up out of the mists, and the mind of man is gradually thawing in the sunlight. Public utility executives are learning that the exercise of helpful constructive service is both more profitable and more enjoyable than practicing any of the subtle arts of defense that they have considered so necessary for so long. But a little while and all this rusty armor of the era of strife will have been laid away, and the industry will discover how much easier it is to serve and grow when the mind is free to think ahead in the service of humanity.

Henry Metcalf Hobart

An author and engineer who applies his talents broadly to the development of engineering and to the cause of standardization.



IN THIS age of engineering specialization Henry M. Hobart is numbered among those who have not been attracted altogether from the path of the general practitioner to the more restricted field of special training and special service on particular engineering problems. He may, in fact, be said to be a leader among those engineers who are applying their talents broadly to all questions of compelling moment and whose training will fit them to cope effectively with almost any problem.

A hard worker, an individualist in his methods and with a high conception of his profession, Mr. Hobart brings an inexhaustible fund of enthusiasm to all questions. To him engineering is at once a business and a hobby. He is an authority on arc welding and has always been a stanch champion of the cause of international and national electrical standardization. The catholicity of his engineering interests is indicated by the wide range of subjects which have held his attention and on which he has written treatises.

He is known for his work in the development of mercury-arc rectifiers, already used successfully abroad, partly because of his pioneering activity, and for his studies in the design of special forms of generator windings. He performed noteworthy service during the war on the welding committee formed by the United States Shipping Board. He has brought the influence of his experience and knowledge to bear strongly on the results accomplished by the International Electrotechnical Commission, of which he is an active member.

Born in Boston, Nov. 29, 1868, where he received his early education, he was graduated from the Massachusetts Institute of Technology in 1889 and for the next five years was connected with the Thomson-Houston Company and afterward with the British company of the same name. Mr. Hobart resigned from the British Thomson-Houston Company in 1889 to become associated as consulting engineer with the Allgemeine Elektricitäts-Gesellschaft, Berlin, and three years later he established an independent consulting practice in London which he continued for eight years. In 1911 he became a consulting engineer for the General Electric Company, the position he now holds.

Among technical societies and associations Mr. Hobart has been particularly active as a member of the standards committee of the A. I. E. E., of which association he is a fellow; of the United States committee of the International Electrotechnical Commission and of the American Engineering Standards Committee.

Editorial Comment

Electrical World, October 27, 1923

Volume 82 Number 17

A Medal Team in Public Relations

A "SAFETY FIRST" medal team of the West Penn Power Company demonstrated its efficiency at the recent meeting of the Pennsylvania Electric Association. These men of the organization were the carefully selected group who had proved most proficient in grasping and applying first-aid principles. Each of them had won a company medal for proficiency, and pride in accomplishment showed in their faces at the Pennsylvania meeting. They came from the rank and file of the company employees.

Why not have a medal team of similar type for proficiency in improving public relations? Annually utility men and executives come together and agree that public relations work is fundamental in their business. Too frequently this is the end of the matter. All go home to attend to business, and because of the pressure of their everyday work their good resolutions about improving public relations soon become only a vague remembrance.

It would seem very possible to appoint a public relations director and organize an educational system in public relations work. Make public relations the definite job of one man and support his efforts by rewarding his proficient students. In public relations as in any other activity everybody's business turns out to be very much nobody's business.

Swallowing Camels and Straining at Gnats

THE attitude of some central-station executives toward investing money in commercial expansion as compared with engineering and plant investment affords a striking example of the biblical paradox quoted above. A case in point has recently come to light:

A certain company with a 3,000-kw. surplus of hydroelectric power serves a city of 50,000 population. It is not an industrial community, so the prospect of selling the excess capacity to power users is slim. However, it is imperative to find a market for the 3,000 kw., and building of transmission lines to connect a number of small towns has been proposed. To do this will cost upward of a million dollars. A commercial survey of the territory to be reached was very discouraging. It showed that nearly one-half the people who compose the population are of a class which would never become customers of the company. There was not enough real business in sight to pay carrying charges on the transmission lines, let alone earn a return on the total plant investment.

As an alternative the commercial man who made the survey proposed that the company adopt a plan of intensive development in the city of 50,000 already served. Residential customers have never been asked to use appliances and commercial customers follow their own judgment as to how much or how little illumination they require. The company's office is in one corner of a building on a back street where all the line material and other general supplies are kept. Customers find their way to this office and pay their bills as they pay their taxes—grudgingly. The commercial man proposes to change all this. He would find a new location in the business section, install an up-to-date electrical store, put on a force of salesmen, offer a 3-cent rate for cooking, and is confident that he can sell the surplus capacity of 3,000 kw. within two years. It could be done with an investment of not more than $50,000.

The powers that be hesitate. They incline toward the transmission lines, as something tangible that could be included in the value of the property. It would represent so much money spent for actual construction which they could feel with their hands, even though it would mean the expenditure of a million or more and not earn its salt. They cannot "see" spending $50,000—one-twentieth of the cost of the transmission lines—to get the business lying right at their feet. They can easily swallow the expensive construction camel, but they strain at the commercial gnat. The thought of putting a comparatively small sum into new business equipment to make their existing investment pay is unattractive.

This is, of course, an extreme case; but such a company does exist. It represents the product of a state of mind which still pervades the industry to a degree and is wasting money every day. To restrict the sales department in this manner, however, is one sure way of maintaining a high ratio of invested capital to annual income. No other business could long exist if its selling force were so hobbled. Still, the condition bids fair to continue until "the men higher up" awaken to the greater value of the dollar earned by intelligent selling over that of the dollar which comes in as a meager return on costly construction into new and unproved fields.

Low Distillation of By-products Making Progress

THE operating performance of the Walkerville station of the Ford Motor Company is awaited with interest by the central-station industry. This station involves the use of low-temperature distillation on a large scale, and if successful, it will afford great opportunities for securing a worth-while reduction in the cost of energy production from coal. Moreover, the scheme is reported to be such that it can be adopted by existing stations with a minimum amount of change in station arrangements. This results from the fact that the by-product plant can be made separate from the station proper.

The system as described consists of the use of a molten-lead bath over which the coal passes continu-

ously, with a resultant distillation of volatile matter which, when refined and condensed, gives appreciable quantities of gas, gasoline, tar, ammonium sulphate and some other oils. The coal after distillation is very largely coke, which can be used by any of the ordinary boiler coal-burning equipments.

Whether successful or not, the installation should determine conclusively the possibilities of using a by-product process in conjunction with the production of electrical energy. This mammoth experiment is but one of many that bring nearer an economic status where the supremacy of electrical power in promoting national prosperity and convenience will be even greater than now.

Simplifying Inductive Co-ordination

DURING the past two years some very encouraging results in handling inductive-interference problems have been brought about by the co-operation of telephone and power companies through the joint committee on inductive co-ordination. The first and fundamental agreement was that both services are essential to the public and that each must be rendered without making it economically impossible for the other to endure. With the subsequent code of principles which has been formulated and agreed upon by both interests a long step has been taken toward solving what once looked to be a very serious problem.

The geographical extent of both services is so great, however, and as a consequence the persons who are familiar with any local situation are so many, that it now appears to be a question how the well-formulated principles can best be applied. The problem is rapidly outgrowing the physical ability of any centralized organization like the joint committee, although this committee or some body with equivalent functions must always be looked upon as the co-ordinating force. At the present stage of the situation it looks as if many of the detailed investigations and conferences prior to the solution of any individual inductive co-ordination problem might be handled locally by sub-committees on inductive co-ordination, the final action to be passed upon or taken by the central body. As an indication that this can be practically undertaken attention might be called to the Nebraska inductive co-ordination committee, which has been functioning in the manner outlined for some time. It has found that local situations can thus be taken up more promptly, with more intimate information regarding the situation and with more closely interested and informed men participating, than in any other way so far tried. Naturally such pioneer work would not be perfectly co-ordinated with the national work, but it is expected that this phase of the matter would show constant improvements.

Whether problems of inductive co-ordination should be handled by state or divisional sub-committees is a question for the joint committee or the N. E. L. A. committee to decide. It must be said, however, that divisional committees might work under more handicaps than a state committee owing to the distances which delegates would have to travel and their less intimate acquaintance with each case. Furthermore, the conditions in each state may differ in such a way that state committees would be in a better position to function effectively.

This subject is already receiving the consideration of the National Electric Light Association, and if it decides that more effective and expeditious action can be secured through the sub-committee plan, it is to be hoped that every interest will co-operate in the establishment and operation of such sub-committees.

High-Voltage Continuous-Current Generators

IT IS interesting to speculate as to what would have been the probable course of the development of electric power transmission equipment if in the early days it had been possible to produce direct-current generators of higher and higher voltages to keep pace with the increasing distances of distribution and transmission. The direct-current generator in its essential elements was a finished machine before the alternator and the transformer, and for a short period before the development of the latter there was a marked delay in the expansion of power distribution owing to the low operating voltage of direct-current generators. Alternating-current transformation and transmission offered so simple a solution as to eclipse completely for a long time some of the advantages possessed by the continuous-current system.

The principal limitation in the increase of voltage in the direct-current generator has been the question of commutation. The first great improvement for offsetting this difficulty was the use of the commutating pole, providing as it does a reversing field at commutation, and so permitting not only increased loading but also higher voltages. But even with this manifest advantage the commutating pole alone has its limitations. It does not completely neutralize armature reaction, and it even introduces troublesome distortion of the normal field flux. An interesting result of a closer study of the commutating pole, and of the conditions in the direct-current armature, is described in a paper presented by S. R. Bergman before the 1923 annual convention of the American Institute of Electrical Engineers. In this paper the author describes the development of a continuous-current generator rated at 15,000 volts and 15 kw. The successful construction of such a machine has been made possible by the use of a compensating winding closely encircling the armature and placed in slots on the field pole, by a distributed form of field winding occupying the same slots, and by the use of a commutating pole with sufficient separation from the field teeth to remove the exciting flux from the coils undergoing commutation. In other words, by the point-to-point neutralization of armature reaction, by a sine-wave-flux distribution, and by proper design of the commutating pole, it has been possible to raise the total voltage to the figure mentioned, notwithstanding the fact that the voltage between commutator bars is approximately four times the present conventional value. The machine also embraces a new type of commutator construction, combining mechanical strength with high insulating properties. It is stated that, in conjunction with vacuum tubes, the machine meets admirably the needs of radio transmission for conversion into high-frequency alternating current, operating continuously with perfect commutation.

It is interesting to recall that some of the advantages of the commutating pole were pointed out very early in the history of the development of the direct-current

machine and that it was neglected over a considerable period of years. Very much the same may be said of the compensating winding. Its advantages were pointed out by Ryan many years ago. While it has had a notable application in various types of alternating-current machinery, particularly in the series commutator motor, its use in direct-current machinery has been practically nil until its introduction in the machine mentioned above.

Two Interests Involved in Patenting Engineering Arrangements

ANY one who is watching the patents issued each week by the United States Patent Office will probably have observed that a number of patents are being granted to engineers for various arrangements of engineering equipment as distinguished from designs of the apparatus itself. No doubt there are more applications for similar patents.

The situation is particularly worthy of consideration in the electrical industry because many utility companies and industrial plants in the United States have been working during the past years of development on the basis that they were free to arrange or install apparatus which they purchased in any way they desired. As an outcome of the new movement toward patenting these arrangements some companies will begin to find that they have independently developed and installed, or even purposely copied, some other company's arrangements of equipment, which were considered free property to all at the time they were adopted, but which have since been patented. For example, patents have been issued on at least one isolated phase arrangement, and others have been granted on various combinations and arrangements of heat-balancing equipment and boiler arrangements. Any company which has duplicated these specific arrangements has technically infringed a patent.

If this wave of patenting engineering arrangements spreads, it is the belief of some engineers that it will seriously hamper the development of the industry because of the preliminary searches which will have to be made hereafter to avoid the infringement of patents and because of the royalties which some companies will have to pay engineers or other companies, where they have intentionally or unintentionally copied some patented arrangement of equipment. While this argument has a logical basis if patents of the kind mentioned increase, it must be remembered that operating companies are not the only ones to face this situation. Ever since the patent system was adopted to permit the inventor of a new device to profit financially from the commercial development of his idea, the same situation has faced all manufacturers. They, too, have been handicapped in using ideas promiscuously, but they have recognized that the originators of ideas are entitled to remuneration and that withholding this compensation would discourage many new developments.

In other words, if this new patent situation comes to a point where it gives prospect of becoming burdensome, every one will have to remember that the two interests involved must receive equal consideration. There is the right of the individual who develops a new idea to profit thereby, but, on the other hand, the development of the industry in which the public has a great interest must not be unnecessarily hampered.

The solution of the problem, if there is any problem, will undoubtedly be found in the practices and the experience of manufacturing companies which now have to contend with the patent situation every day in the development of new apparatus. Some of these companies have taken the broad-minded attitude of allowing engineers to patent ideas which they have developed in their employ and then paying them an equitable price for the patent. Other companies require that all employees sign a contract relinquishing patent rights secured while in their employment to the employer. Between independent manufacturing companies there are signs of co-operation in the form of an exchange of patent rights. Whether these methods are applicable or desirable in the utility and industrial fields, where so many more companies are involved, is a question.

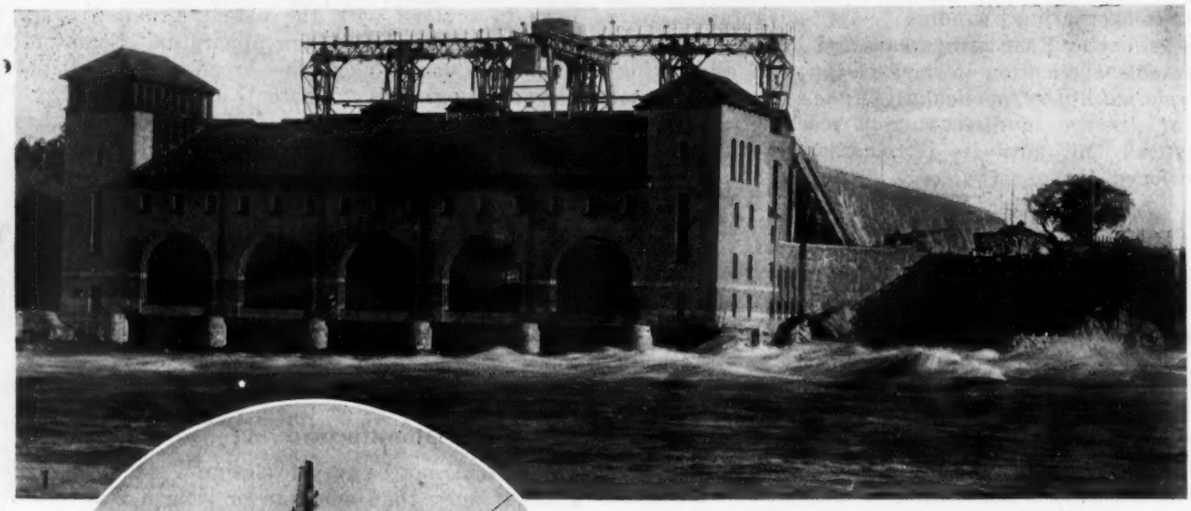
Standards in Hats and in Manufacture

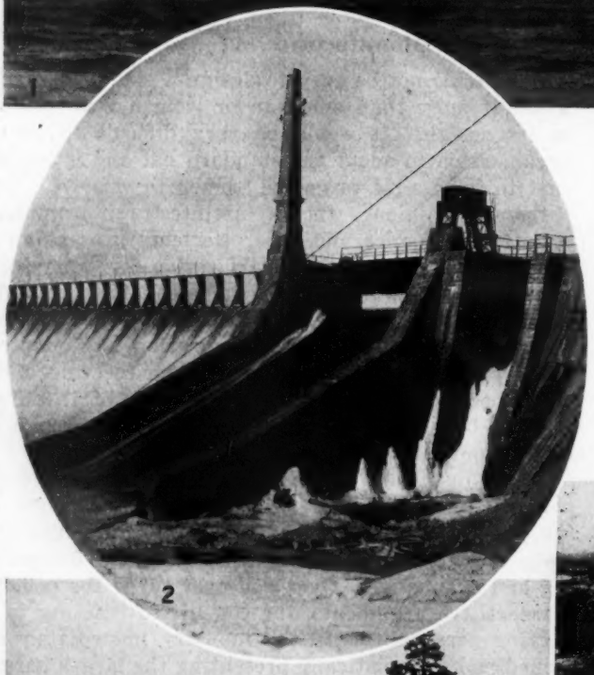
IT WOULD not be easy to design a standard woman's hat if more than one man or woman was concerned in its design. It would be very difficult to get any organization to adopt the standard hat and it would be next to impossible to get all women to wear it. Style, personal opinion, facial architecture, complexion artistry, economics and other elements present an impassable barrier to hat standardization. In some degree, depending on the article, this same condition holds true in manufacture. The archives record many instances where a committee or an organization has adopted a standard device or specification which became a dead letter because the user would have none of it. Standards, to be worth while, must be followed through and carried out as commercial practices.

It is just such conditions—commercial jealousies, personal animosities, false economic conclusions and the general cussedness of humans by and large—that make the work of any standards committee disheartening and exhaustive. Over and over turns the treadmill of repetitive arguments, the committee reacting to the varying personalities in the industry immediately concerned and diplomatically presenting the larger perspective to conscientious objectors. Progress is snail-like and its a "fifty-fifty bet" whether standards when adopted will be followed. Yet progress does occur under these conditions, and the most cursory view of the accomplishments of engineering standards committees gives cause for congratulations to the committees and to industry. Steadily, persistently they are carrying forward the work, and industry is beginning to appreciate the substantial value of their recommendations. As a result, a large proportion of the adopted standards are carried into commercial practices.

The principle of standardization is of especial appeal and interest within the electrical industry because of the complexity of the products, the desire to simplify electrical equipment in the interest of popular understanding, and also a natural caution lest the expansion of the industry be curbed by repressive measures. And so it is ever a live topic before electrical men and an accepted common objective. Long-continued educational activities, fair treatment, unbiased judgment, co-operative attack and infinite patience have produced the present encouraging situation in standardization activities, and easier and easier become the tasks of standards committees because the work has been tried in the crucible of commercial competition and found worth while to industry.

Typical Swedish Hydro-Electric Developments





1. The 55,000-kw. state plant at Älvkarleby is a splendid example of the standard Swedish low-head type of construction. The head is 60 ft.

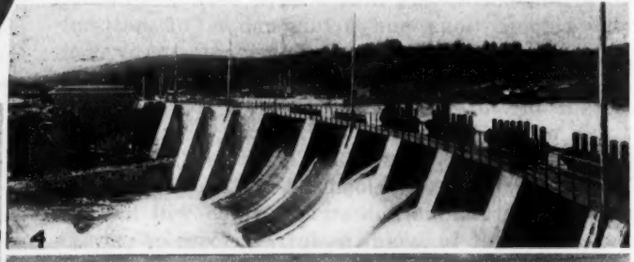
2. The intake dam at Porjus has 600 ft. of Ambursen type spillway and a 40-ft. timber chute with a roller gate.

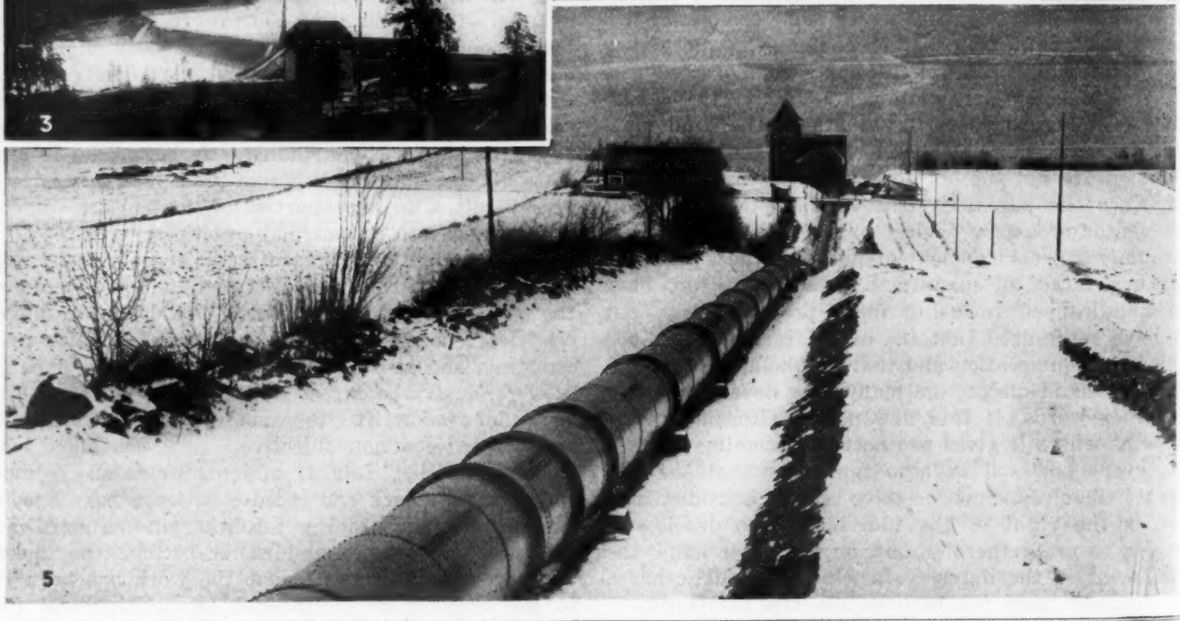
3. At Porjus the waters of Greater Lule River are led to and from the turbines through tunnels and the distribution basin is roof covered to prevent freezing during the four-months arctic night.

4. Yngeradsfors is another typical low-head plant.

5. Röttle, near the Lake Vättern, is one of the few Swedish plants with more than 300-ft. head.

Illustrations Nos. 2, 3 and 4 are published by courtesy of Borgquist, Sweden. Illustration No. 5 by courtesy of Vattenbyggnadsbyran, Stockholm.





Water-Power Development in Sweden

Far-Flung System of Low-Head Plants Extending to the Arctic Circle Is Fast Being Interconnected Into One Great Group—How Hydro-Electricity Is Supplemented by Steam

By W. BORGQUIST
Director of Plant and Operation, Royal Board of Waterfalls, Stockholm

A SURVEY recently made by the Swedish Electrification Committee showed that about 750,000,000 Swedish crowns ($200,000,000) is invested in electric generating and distributing plants in Sweden. The total railroad investment is only about 1,600,000,000 crowns, or little more than twice as much, indicating what an important part the electric power industry plays in the economic life of the nation. The energy production is estimated at about 2,500,000,000 kw.-hr. per annum, with an aggregate peak of about 1,000,000 kw. The greater part of the energy is utilized in high-class industrial and domestic service, as shown in the tabulation below:

	Per Cent
Wood, wood pulp and paper mills	35
Mines, iron and steel works	10
Mechanical industries, textile mills, etc.	10
Railways and railroads	5
Domestic uses in cities and towns	5
Farms and villages	5
Electrothermic and electrochemical industries and steam generation	30

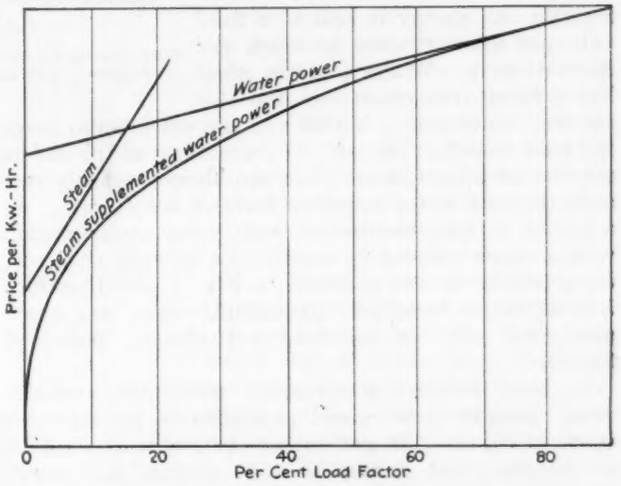
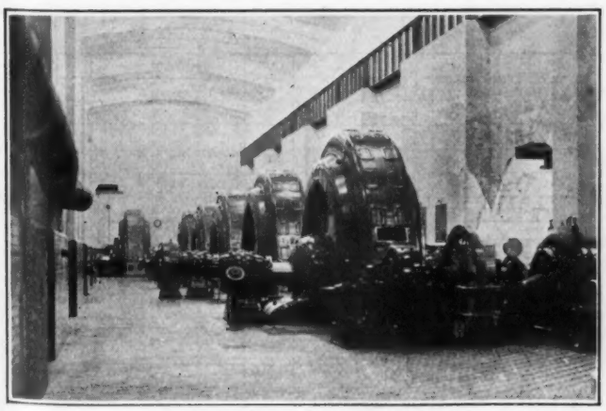
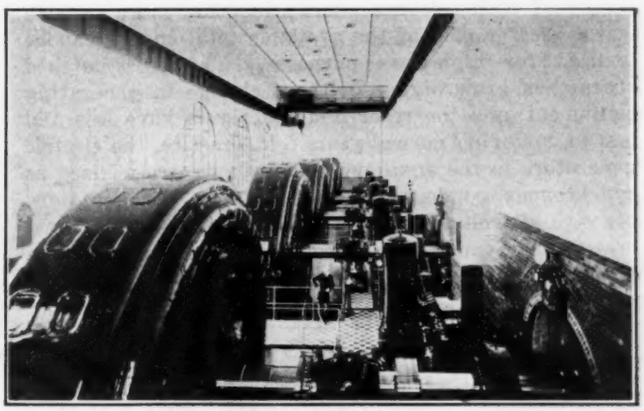


FIG. 1—STEAM SUPPLEMENTED WATER POWER COMPETES SUCCESSFULLY WITH LOCAL STEAM PLANTS EVEN FOR PEAK ENERGY

Although about 95 per cent of the energy is generated in hydro-electric stations, steam stations have played and still play an important part. The first electrical power stations were local steam plants, and through them a market was developed. The steam plants, therefore, paved the way for the hydro-electric developments, while at the same time serving as competition and automatically keeping the price of hydro-electric energy down to a level corresponding to the lowest possible fuel and maintenance cost of steam-generating stations. With the rapidly increasing power demand, however, hydro-electric energy had to be utilized more and more, and the steam stations finally acted only as stand-by stations or were used at peak loads. Thus the bulk of the load was supplied from water-power stations. However, for a time this increased the difficulties of hydro-electric development because it was not possible at first to utilize the generating and transmitting plants at full capacity.

Competition between water power and steam power has however, gradually subsided, and by increasing the reliability of service and offering reasonable rates the hydro-electric systems have now secured the greater part of the power business. Steam stations are maintained for use at low-water periods and to supplement the available water-power supply of energy, particularly at times of peak load and during seasons of flood water, when the head in hydro-electric stations is reduced. By





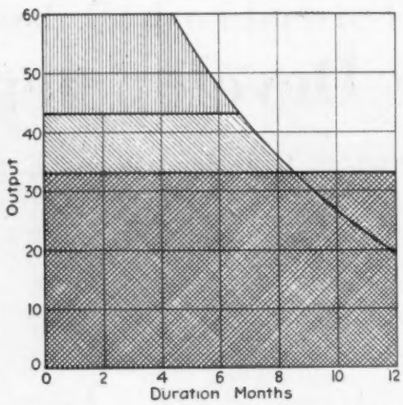
HORIZONTAL UNITS ARE USED IN LOW-HEAD STATIONS

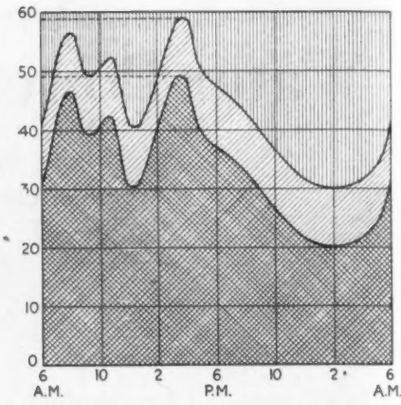
At Left—The generator room at Älvkarleby contains only the alternators and governors. The turbines lie to the right, in open turbine chambers, while all switching equipment is in the substation building, on the bank of the river to left of the station.

At Right—The subterranean generator room at Porjus, hewn out of solid rock.

this means centralized water power, supplemented by centralized steam power, is able to compete successfully with local steam stations even for the peak load. This, of course, does not apply in industries where low-grade by-products and refuse are burned, as for instance, sawdust, or to the paper and sulphite industries, where a great deal of steam is used for heating purposes.

The cost curve of a hydro-electric plant usually takes the shape shown at top in Fig. 1. Consequently, in Sweden, the energy is sold at a fixed rate per kilowatt plus so much per kilowatt-hour. While a steam plant has a lower investment cost the cost per unit developed is higher and the price curve takes the form shown at the left. A comparison of the curves shows that a local steam plant can always compete successfully with water power on loads of low factors. As a matter of fact, however, a large water-power station with a steam standby is usually able to work on a cost curve similar to the parabola in Fig. 1, and therefore is in a position to compete successfully with a local steam plant, not only on base-load but also on peak-load business.





FIGS. 2 AND 3—(AT LEFT) AVAILABLE POWER IN STEAM SUPPLEMENTED WATER-POWER PLANT. (AT RIGHT) AVERAGE LOAD CONDITIONS IN THE HIGH-WATER SEASON

In large Swedish water-power plants the available power usually varies about as shown in the duration curve in Fig. 2. The generating equipment as a rule is so designed that it may be fully utilized for energy production during four or five months of a normal year. The demand, however, is greater than the available nine months' power, so that steam power must be used to supplement water power, and a block of energy corresponding to the cross-hatched area in Fig. 2 is made available all the year. Fig. 3 shows the load variation during a normal day with full water supply. If sufficient day-to-day hydraulic regulation facilities are available, the primary power cross-hatched is taken care of all the year by the combination of water power and steam. During six to eight months secondary power, corresponding to the obliquely lined area, is delivered on a yearly contract basis at reduced rates and during flood season off-peak energy, corresponding to the vertically lined area, is dumped at very low rates in electric-steam boilers, in pulp mills and similar plants.

By hydraulic regulation and co-operation and interconnection of the different generating stations the supply of hydro-electric energy is made more reliable and a greater part of the available total energy can be utilized for high-class purposes. The cross-hatched areas then grow bigger, without change in generating equipment, and the reserve steam plants have less and less to do during normal years. In practice, the electric generators in the auxiliary steam plants are utilized as synchronous condensers for supplying the necessary reactive kilovolt-amperes so that the hydro-electric generating equipment may be utilized to full kilowatt capacity.

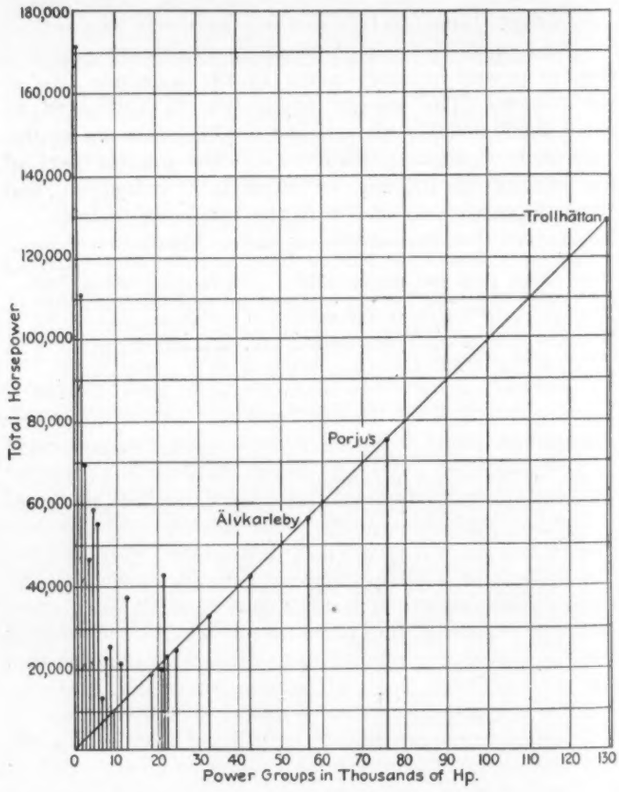


FIG. 4—SWEDISH HYDRO-ELECTRIC DEVELOPMENTS ARRANGED IN GROUPS ACCORDING TO OUTPUT

MANY SMALL POWER SITES WITH LOW HEAD

If Sweden's hydro-electric stations are grouped according to rating, and the aggregate turbine capacity of each group is plotted against the group individual rating, a diagram like that in Fig. 4 is obtained. The diagram shows that the evolution has been rather

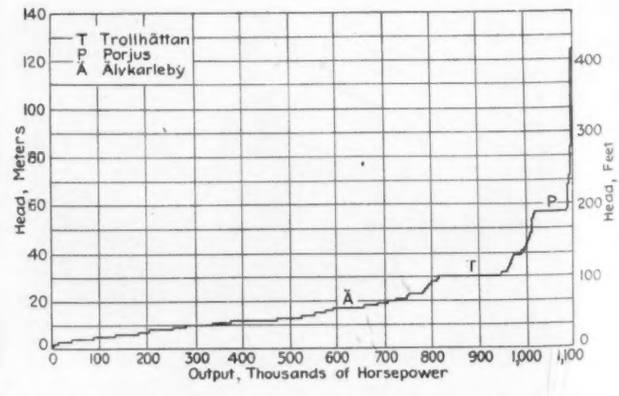


FIG. 5—THE MAJORITY OF THE SWEDISH WATER-POWER STATIONS ARE OF A LOW-HEAD TYPE

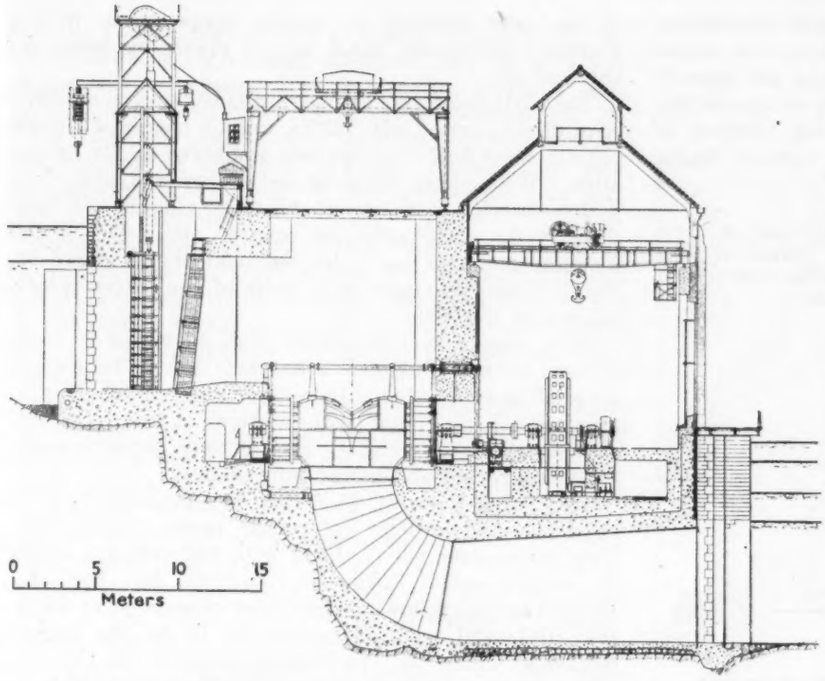
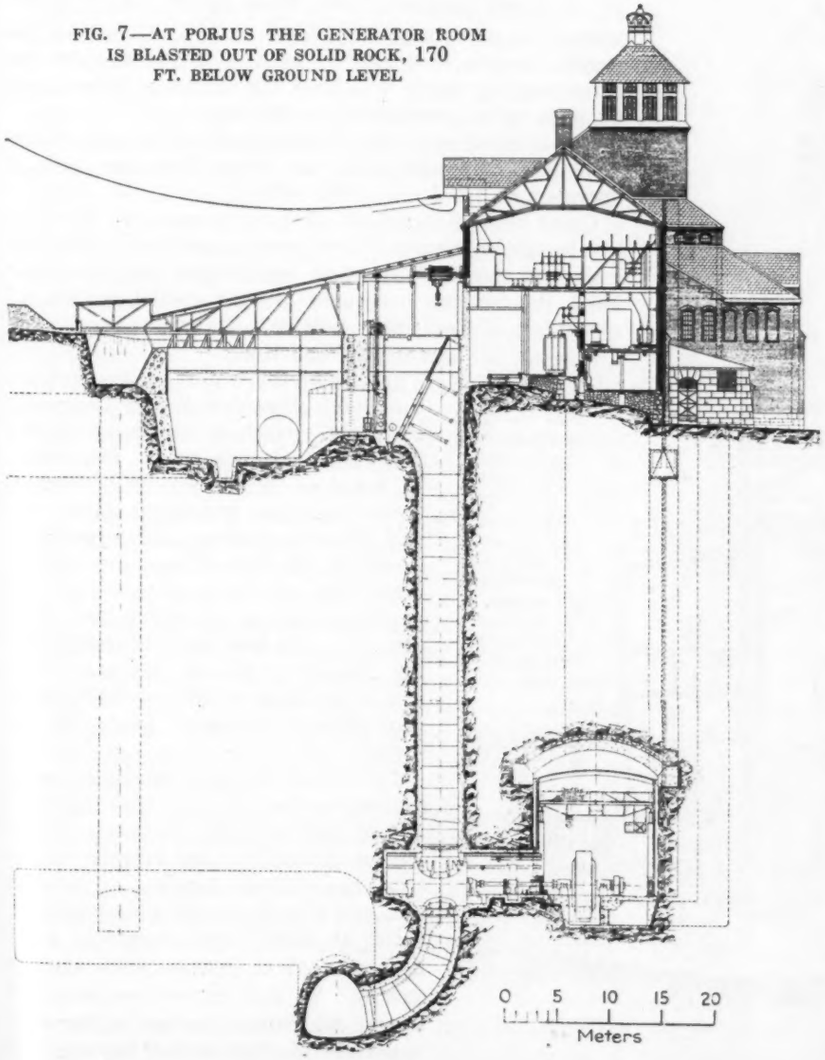


FIG. 6—THE UNTRA PLANT IS TYPICAL OF A LARGE GROUP OF SWEDISH WATER-POWER STATIONS WITH LOW HEAD

FIG. 7—AT PORJUS THE GENERATOR ROOM IS BLASTED OUT OF SOLID ROCK, 170 FT. BELOW GROUND LEVEL



democratic in character, as a considerable part of the total turbine capacity is represented by stations of very moderate size. The diagram of Fig. 4 was made by the Royal Board of Trade in 1917, and if brought up to date would show the same tendency, only more pronounced, since the fuel crisis during the years 1918-1920 caused a considerable number of more or less unimportant sites to be developed.

The majority of Swedish water-power stations operate under low hydrostatic heads. This is shown very clearly in Fig. 5, where the stations are grouped according to height of head. Each station is represented by a horizontal line proportional in length to the turbine capacity. It will be seen from the diagram that about 85 per cent of the hydro-electric capacity is represented by stations operating under a head of a hundred feet or less.

The low head has naturally resulted in a relatively high investment per horsepower. However, investigations by the Royal Board of Trade have shown that at heads above 15 m. the specific investment decreases very slowly with the increasing head. Stations rated at more than 5,000 turbine horsepower show an average investment of 300 crowns ($80) per horsepower. Although many plants were built or enlarged during the war, the average investment cost is only about 50 per cent above pre-war value.

SOME TYPICAL STATIONS

Some typical Swedish power stations are illustrated in Figs. 6 to 10.

The Röttle power plant, shown in section in Fig. 8, operates under a head of 105 m. and is an example of the few high-head plants in Sweden.

The Porjus station on Lule Alv—near the Polar Circle—with its 57-m. head, represents the medium high-head group. In this station the generator room is a subterranean chamber blasted out of solid rock. Similar construction has also been used in the power station at Mockfjärd on Västerdalälven and will be used for a number of projected large power stations, where a series of rapids is utilized rather than one concentrated waterfall.

The Untra power station on the Dalälven is typical of a great number of medium low-head plants. It has open concrete turbine chambers and horizontal-shaft twin turbines, operating under a head of 12.4 m.

Of a similar type, but belonging to the extreme low-head group (5.5 m.) is the Fleminge power station, shown in Fig. 9, with its horizontal double-twin turbines.

Fig. 10 shows the station at Lilla Edet, a more recent development in the same group, which is now under construction on the Göta Alv. This plant will operate under a head of from 6 m. to 7 m. with a minimum flow of about 400 cu.m. per second. By using turbines of the Kaplan and Lawaczeck types, with vertical shafts, it has been possible to employ large units, with a diameter practically equal to the operating head, for this station.

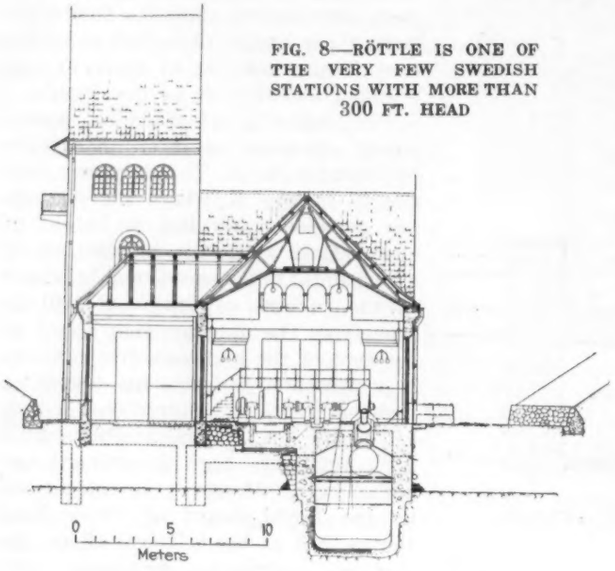


FIG. 8—RÖTTLE IS ONE OF THE VERY FEW SWEDISH STATIONS WITH MORE THAN 300 FT. HEAD

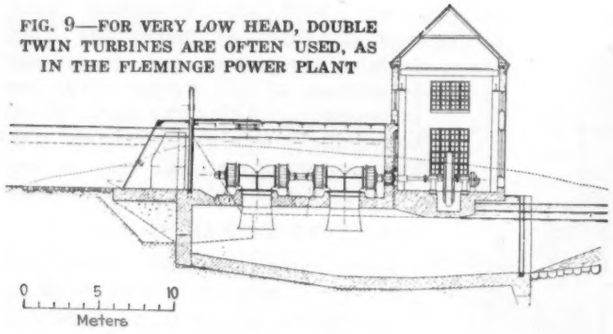


FIG. 9—FOR VERY LOW HEAD, DOUBLE TWIN TURBINES ARE OFTEN USED, AS IN THE FLEMINGE POWER PLANT

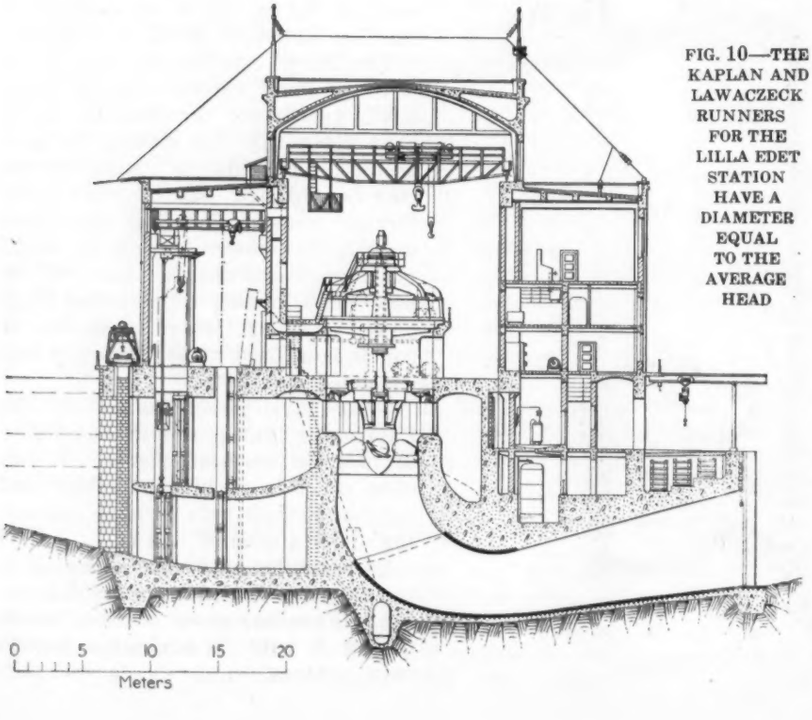


FIG. 10—THE KAPLAN AND LAWACZECK RUNNERS FOR THE LILLA EDET STATION HAVE A DIAMETER EQUAL TO THE AVERAGE HEAD

The early local stations were almost always equipped with direct-current generators, and by means of storage batteries the fuel economy was improved as far as possible. With cheap three-phase energy available from hydro-electric stations alternating current is used directly for distribution in suburbs and newly settled districts and also has a decided tendency to crowd out the direct-current system in spite of the better reserve offered by the latter.

It is now generally agreed that 50 cycles is to be chosen as the standard frequency for a future all-Swedish power system. In southern and middle Sweden hundreds of individual power stations of this frequency, state-owned and private, are already interconnected for co-operation and power interchange.

The voltage series 44-77-132 kv. probably will be chosen as standard for interurban power transmission. This series does not conform with the voltages chosen in certain other European countries, but has been adopted for the following particular reasons: (1) Forty-four thousand volts is considered to be the highest voltage at which pin-type insulators may be used on long lines with complete reliability. (2) There is no material difference in cost for a chain insulator line when the voltage is raised from 66,000 to 77,000 and hence there is no reason to stop at any value below $\sqrt{3} \times 44{,}000$ volts. (3) A voltage of 132,000 ($\sqrt{3} \times 77{,}000$) is the lowest tension that can be used to advantage for interconnecting trunk lines over the distances determined by geographic conditions in Sweden.

For lines of moderate length 22,000 volts and 11,000 volts are generally used, and local lines are usually operated at 3,300 and 1,650 volts.

Great simplification of substations has been obtained by abolishing the use of horn gaps, condensers, induction coils and similar protective equipment. On the other hand, interest has been concentrated on the problem of obtaining a perfectly reliable insulation for transformers and lines.

In the southern part of the country, the South Swedish Power Company, privately owned, is the most important electrical enterprise. Its system is supplied from seventeen water-power stations, including the Lagan and Hemsjö stations, and aggregates about 50,000 kw. These are supplemented by two steam stations, with an aggregate rating of 18,000 kw. This company also has acquired control of the Finsjö plants on the east coast and is building a 132,000-volt line to interconnect different parts of its system.

In central Sweden the state power system predominates. The interconnected hydro-electric stations at Trollhättan, Alvkarleby and Motala, with a total generating capacity of 175,000 kw., and the steam plant at Västeras, rated at 40,000 kw., supply a great part of central Sweden with electric energy. To this system are also tied almost all private power systems of importance in that part of the country.

For two years a regular interchange of electrical energy has been going on between the interconnected stations, in many cases under long contracts. Certain misgivings have been felt regarding the advisability of tying together such a great number of synchronous stations, and of course it has been necessary to take certain precautions, but on the whole the plan has worked out very well.

Among private enterprises in southern Sweden which co-operate with the state system are the Yngeredsfors Power Company, with a generator rating of 10,000 kw.; the Gullspäng-Munkfors Power Company, with 18,000 kw., and the municipal system of Norrköping, with 5,000 kw.

In the iron-mining district in central Sweden the greater part of the existing water-power stations are operated by a common management, the Bergslagens Gemensamma Kraftförvaltning Company, the biggest co-operative combination of its kind in Sweden. To this system, which is also connected to the central network, belong the power stations of the Grängesberg-Oxelösund Company, with a total of 17,000 kw., and those of the Stora Kopparbergs Bergslags Company, aggregating 40,000 kw., located at Mockfjärd, Bullerfors, Kvarnsveden, Forshuvudforsen, etc. In the same region lies the Hällefors Bruks Company system, a combination of about twenty smaller hydro-electric stations, totaling about 15,000 kw.

The Uddeholm Company has developed 45,000 kw. in a number of waterfalls along Klarälven. These stations operate at 25 cycles and are not connected to the central power group. Another isolated 25-cycle system is Stockholm's municipal plant at Untra, with 30,000 kw. installed generator capacity, which is supplemented by a steam station of 33,000 kw. at Värtan, near Stockholm.

In the northern part of the country interconnection has not progressed very far and is mostly local in character. Following the coast northward, there are the power systems of the Bergvik-Ala Nya Company (4,000 kw.), the Arbra Company (3,000 kw.), the Skönvik Company (5,000 kw.) and the Kramfors Company (8,000 kw.). Further inland are the plants at Alby and Ljungaverk, with a total of 25,000 kw., and Hissmoforsen, with 7,000 kw.

These regions are still rich in undeveloped water power, but the power resources of central Sweden will be fully developed in a few years. To meet the steadily increasing demand for power in the industrial regions of central Sweden it will therefore be necessary to transmit power from the north. Anticipating this necessity, the state has purchased certain water rights in Norrland, among others at Stadsforsen on the Indalsälven, where about 100,000 kw. may be made available. In the not distant future a 132,000-volt line will probably be built from Stadsforsen to Västeras, and the last-mentioned isolated northern power systems then may be linked up with the central power group, if conditions should warrant.

In the Far North the most important electric power system is that of Porjus, where at present 55,000 kw. is developed. The power station at Porjus mainly delivers single-phase energy to the electrified railroad from Lulea to Narvik and three-phase to the Gellivare mines, but the entire northern coast district soon will be supplied with industrial and domestic power from this source.

It was recently decided to begin at once to electrify the railroad between Stockholm and Gothenburg as a first step toward a more general electrification of the main railroad lines. This railroad is to be supplied with energy from the general system of the central group, and this probably will tend to strengthen the existing tendency toward co-operation. Moreover, the lines of the South Swedish Company will very probably be linked up with the central group before long by a 132,000-volt trunk line between Trollhättan and Lagan, which in its turn may ultimately enter as a link in a projected inter-Scandinavian power system, carrying water power from Norway and Sweden to Denmark, and perhaps still further southward into Germany.

FIG. 11 — IN SOUTHERN AND CENTRAL SWEDEN HUNDREDS OF PRIVATE AND STATE-OWNED GENERATING STATIONS ARE INTERCONNECTED TO ONE "CENTRAL GROUP"

What It Means to Change from Overhead to Underground*

Meeting the Demand for an Underground Installation Before It Crystallizes—Allocation of Costs Between Utility and Consumers

BY H. N. MULLER
General Superintendent of Distribution Duquesne Light Company

MANY executives of electric light and power companies in the smaller cities are faced with the proposal that all or part of their overhead system shall go undergound. Very often the city council will meet and request the utility executives to attend on very short notice and tell them the elements involved in changing to an underground system.

There is no question that the appearance of a city is improved by having all wiring underground, but it is only fair to all concerned to make it clear that this improvement will cost a great deal of money and that this money must be obtained from the citizens through increased rates and through the direct cost to them of changing their service from overhead to underground.

Unpleasant public relations can often be avoided if full knowledge of the facts can be brought home to the people before the movement crystallizes into an unwise program of underground construction. The obligation for presenting these facts rests upon the executives of the utility companies, and, even though they may have no underground system on their property, they should be conversant with the arguments pro and con and should know something about the costs involved. Friendly discussions based on knowledge seldom fail to result in decisions satisfactory to all.

An examination of costs indicates that the investment in overhead systems later changed to underground systems is less than that in the underground installation in a ratio of from one to four and one to six, depending upon local conditions. These costs are based on a study of certain areas in the larger cities of Pennsylvania which have undergone the transition from overhead to underground. It is felt that these costs will apply with fair accuracy to those involved in changing from overhead to underground in the business districts of medium-sized cities.

But, in addition to the increased investment cost to the utility, the consumers must pay for changing their service outlets and equipment from the overhead location and type to the underground location and type. This involves the labor, repair work and equipment needed to change the conduit inside the premises and to run cable from the basement to the property line. The changes within the premises involve direct costs ranging from $40 to $150, and the cost of conduit and cable varies from $75 to $150. This means that each consumer will be required to pay out from $115 to $300 if his service is changed from overhead to underground.

Another rather indefinite cost element and potential source of bad feeling is encountered in making repairs or installing underground installations in residential districts. It is sometimes necessary to destroy sidewalks and roadways, dig trenches in the lawns, remove trees, damage shrubbery and destroy other features of the landscape which have an intrinsic value in the opinion of the property owners.

Added to this are legal questions involving the right of the utility company to replace or remove equipment on the customer's premises and the possibility that the utility may find difficulty in financing the equipment installed on the customer's property. As a general proposition, therefore, it is advisable for the customer to own all the equipment on his property with the possible exception of the meter.

In a regulated business, such as the light and power industry, if investment costs are increased by changing

*Based on the report of the underground systems committee of the Pennsylvania Electric Association, 1923.

COST OF UNDERGROUND INSTALLATION IN SUBURBAN DISTRICT WITH APPROXIMATE POPULATION OF 7,000

Note.—Built on residential street. Costs 1917.

Length, Ft.	No. Ducts	Paving	Cost—Total	Cost—Trench-Foot	Cost—Duct-Foot
7,493	6	Bituminous macadam	$11,471.00	$1.53	$0.255
8,338.7	9	Bituminous macadam	15,360.00	1.84	0.205
931.7	12	Bituminous macadam	1,997.00	2.14	0.179
16,763.4			$28,828.00		
Cost of installing three-conductor No. 1/0, 13,200-volt cable			$15,286.00		$0.90
Manholes, 47 at $212.20 each					9,874.00
Miscellaneous and engineering					1,113.00
Duct system					28,828.00
Total duct system					$39,815.00
Trench-feet, 16,763. Duct-feet, 131,180.					
Total cost subway per duct-foot					$0.304
Total cost subway per trench-foot					2.38
Total cost table per foot					.90

COST OF UNDERGROUND INSTALLATION IN A CITY OF 150,000 POPULATION

Lengths, Ft.	No. Ducts	Paving	Cost per Trench-Foot	Cost per Duct-Foot
15,436	16	Dirt	$2.293	$14.33
1,174	12	Dirt	2.004	16.70
3,980	12	Brick	2.794	23.27
55	12	Asphalt	3.514	29.30
4,171	8	Dirt	1.548	19.35
598	8	Asphalt	2.583	32.30

Special Crossings

Length, Ft.	No. Ducts	Description	Total	Per Trench-Foot	Per Duct-Foot
296	8	Creek (4-in. iron pipe)	$1,006.90	$3.40	$42.50
391	16	Railroad junction, inc. temporary crossing, 4-in. iron pipe	4,007.93	10.51	65.70
300	16	Main line (clay)	934.08	3.12	19.48
90	12	Canal (3½-in. iron pipe)	2,855.09	3.17	26.43

Manholes
(Not including covers or rims)

No.	Kind	Material	Paving	Cost, Each
54	Straightaway	Concrete	Dirt	$155.23
1	Straightaway	Concrete	Asphalt	180.73
2	Straightaway	Concrete	Brick	178.18
1	Straightaway	Brick	Asphalt	180.73
3	Straightaway	Brick	Brick	178.18
1	"T"	Concrete	Dirt	163.63
1	Straightaway	Concrete	Brick	184.63
1	Straightaway	Brick	Dirt	163.63
6	"L"	Concrete	Dirt	163.63
1	"L"	Concrete	Asphalt	192.33
2	"L"	Brick	Brick	183.63
1	Spec. No. 71	Concrete	Dirt	155.23
1	Spec. No. 74K	Brick	Brick	183.63

	Per Manhole
Covers and rims	$48.60
Total cost, not including engineering, drawing or inspection	81,335.68
Engineering, drawing and inspection	3,669.00
Total	$85,004.68

Division of Costs

Total cost of work		$190,482.61
	Conduits	Cables
Conduit	$79,377.95	.....
Cables—three-conductor, 300,000 circ.-mil, 11,000 volts	.....	$103,051.40
Drawing and inspection, 75 and 25 per cent	1,978.75	659.58
Engineering, 75 and 25 per cent	1,652.28	550.76
Cable racks	943.29	.....
Cable bending	.....	511.21
Cable fireproofing	.....	154.25
Tools	.....	11.12
Cable testing	.....	539.61
Temporary crossing system junction railroad	935.94	.....
Manhole targets	116.47	.....
Total	$85,004.68	$105,477.93
Total trench-feet		26,491
Total duct-feet		362,140
Total cable-feet		70,249
Total cost subway per trench-foot		$3.21
Total cost subway per duct-foot		23.47
Total cost cable per cable-foot		1.50

the distribution system from overhead to underground, rates must be increased to conform to changed cost conditions.

Thus, in addition to the direct charges involved, each customer will eventually pay a higher rate for the energy he uses. These items of cost therefore simply lead to the conclusion that the consumers must pay ultimately and immediately for the cost of having an underground system whose chief advantage is that it improves the appearance of the city streets.

Typical underground installation costs prepared by Mr. Parmelee of the Philadelphia Electric Company are given in the table. These costs are merely typical and should not be used for estimating purposes. Exact costs must be obtained by an analysis which considers all local conditions, including the character of the subsurface and the costs of labor and material.

The demand for underground systems can oftentimes be answered by using improved overhead construction and by placing all possible lines and equipment on side streets or in alleys.

The public and the leaders in the movement for underground construction should be informed that it involves direct and immediate trouble and expense to the consumer and an increase in rates to recompense the utility for its increased investment and greater operating costs.

Precipitate action should be avoided and a carefully prepared co-operative report on the merits of the situation should be the first step in assembling data upon which to make an intelligent decision. The fact should be emphasized that the utility company is part of the community and is as desirous as any citizen to improve the appearance of the streets provided that the cost can be handled without creating bad public relations or an excessive rate for energy.

Power-Factor Correction with Converters

While Converters Should Not Be Used at Rated Output Unless Power Factor Is Near Unity, Reactive Compensation May Be Had at Leading Power Factor by Reduction of Direct-Current Output

By CLIFFORD W. BATES
Research Engineer, Philadelphia Electric Company

STRUCTURALLY the synchronous converter is capable of compensating a lagging power factor, but there are very definite limitations to this use. It must be operated very close to 100 per cent power factor if it is to be used for direct-current load even approaching the rating, otherwise heating is excessive. Analysis shows, however, that the lightly loaded converter may be used to some extent for power-factor correction, and roughly the loads may be such that the arithmetical sum of the reactive kilovolt-amperes and the direct-current outupt in kilowatts is equal to the rated direct-current output.

The effect of the booster element of a booster converter is to bring about an increase in the heating which is roughly proportioned to the increase in voltage and independent of the increase in heating caused by operation at low power factor.

Since heating is the limiting factor in the use of the converter for power-factor correction, it might be well to review briefly some of the internal conditions. The alternating current supplied from one phase traverses the entire group of armature coils connected between the phase terminals, reaches its maximum in each coil of the phase group simultaneously and reverses simultaneously in each coil. These coils are connected to adjacent commutator segments which reverse the direct current in each coil successively. The actual current existing in each coil is the difference between the alternating-current input and the direct-current output, the one sinusoidal and in phase in the coils and the other rectangular and out of phase in the coils. The resultant current wave shapes are different in each coil. For unity power factor the resultant current is a minimum in the coil located at the center of the phase group and increases in magnitude as the tap coils are reached, where it and the consequent heating are at maximum. In a six-phase converter the heating produced in a tap coil is 2.21 times that developed in the mid-coil, and the average heating is 1.4 times that in the mid-coil.

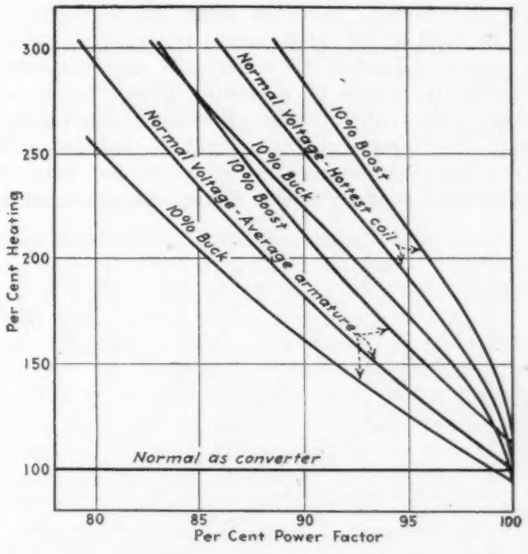


FIG. 1—RELATION BETWEEN FULL-LOAD HEATING IN ARMATURE OF SIX-RING BOOSTER CONVERTER AND POWER FACTOR, REFERRED TO HEATING AT NORMAL FULL-LOAD OPERATION

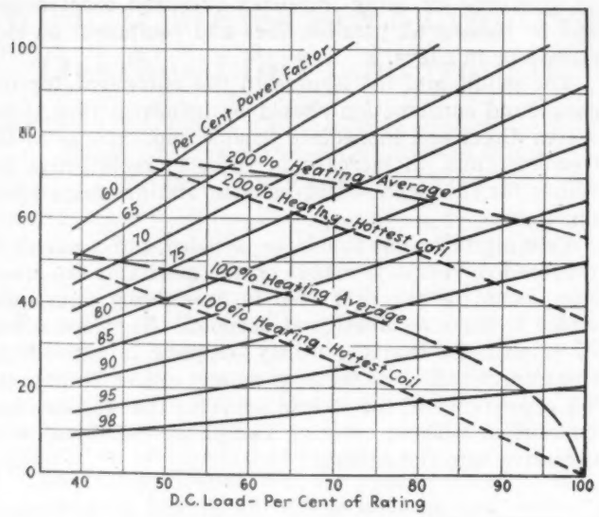


FIG. 2—RELATION BETWEEN HEAT DEVELOPED IN HOTTEST COIL OF SIX-RING BOOSTER CONVERTER AND POWER FACTOR FOR VARIOUS VALUES OF D.C. LOAD

When the power factor is not unity the minimum heat is produced in some other coil than the mid-coil. For example, suppose the current leads the voltage 15 deg. The alternating and direct currents will be in phase opposition in that coil which is 15 deg. ahead of the mid-coil, but the heat developed in this coil will be greater than that of the mid-coil at unity power factor because of the increase in the magnitude of the alternating current caused by the power-factor change. The heat developed in the leading tap coil will be reduced, that developed in the lagging tap coil will be increased, and that in the armature as a whole will be increased.

It is evident, therefore, that the converter should not be used at its rated output unless the power factor is closely adjusted to unity. It is, however, quite feasible to operate at a leading power factor so as to obtain very considerable reactive compensation, provided the direct-current output is reduced. With a direct current output limited to 80 per cent of that permissible at unity power factor, the converter may be used to supply a reactive component which in kilovolt-amperes is from 18 to 33 per cent of the rated kilowatt output, the exact figure depending on the possibilities for heat interchange between the various armature coils. This is to be compared with the 60 per cent reactive correction possible with synchronous-motor operation under the same conditions.

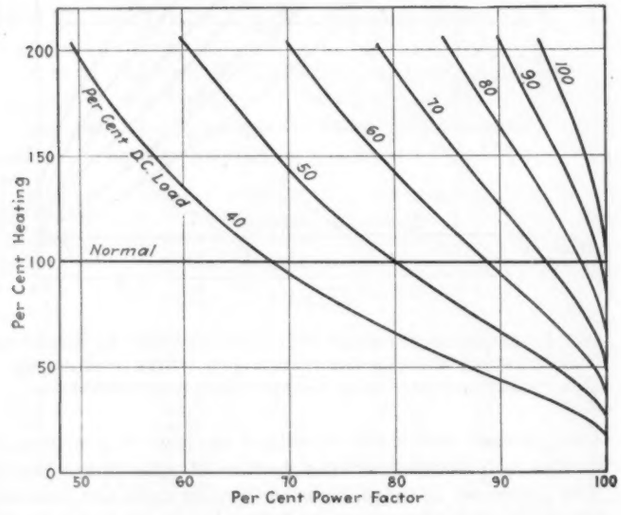


FIG. 3 — RELATION BETWEEN REACTIVE AND DIRECT-CURRENT LOADS OF SIX-RING BOOSTER CONVERTER FOR VARIOUS POWER FACTORS, SHOWING ALSO LIMITING LOADS FOR 100 AND 200 PER CENT OF NORMAL HEATING

FIELD MUST BE CONSIDERED

Since the supply of leading reactive load depends on the possibility of increasing the excitation above that necessary for normal full-load operation at unity power factor, the field coils must be capable of carrying the extra current. In order to permit the converter to operate at 50 per cent direct-current load with 45 per cent reactive load, the induced voltage must be increased about 10 per cent above that required for full-load unity-power-factor operation. This will require roughly 20 per cent increase in the exciting current, which in turn will heat the fields 40 to 50 per cent above the normal value.

The effect of the booster elements of a converter of this type as regards heating must be considered. If the booster is used to reduce the output voltage, it acts as a synchronous motor, helping to drive the converter proper, and the input is correspondingly decreased. The relative phase of the induced voltages in the booster and converter is determined solely by the relative position of the armature on the shaft, which should be such that the voltages are in phase. In this case the additional current due to the booster action is a power component only of the total input current.

DETERMINATION OF TOTAL LOAD WHICH MAY BE CARRIED

D.C. Load	Reactive Load at 100 per Cent Heating, Based on Hottest Coil	Reactive Load at 100 per Cent Heating, Based on Average Armature	Arithmetical Sum, Based on Hottest Coil	Arithmetical Sum, Based on Average Armature
40	48	51	88	91
50	41	48	91	98
60	34	44	94	104
70	27	39	97	109
80	18	33	98	113
90	9	24	99	114
100	0	0	100	100

A series of curves can be used to show the operation of the converter for power-factor correction. The curves were calculated for a six-phase converter, but the general conclusions as to heating, etc., apply to other types as well. The assumption was made that the rotational losses were constant and equal to 4 per cent of the input at full load, unity power factor, normal voltage.

The curves of Fig. 1 show the relation between the full-load heating in the armature of a six-phase booster converter and the power factor referred to the heating at normal load operation. Normal 100 per cent heating is considered to be the heating which exists at full-load current, 100 per cent power factor and normal voltage, in the hottest coil and in the average armature respectively when operating as a converter.

The relation between the heating of the hottest coil of a six-ring converter armature and the power factor for various constant values of the output is shown in Fig. 2. The curve for 100 per cent load is the same as the "normal voltage," hottest-coil curve of Fig. 1. The curves indicate quite a field of operation for lightly loaded converters without exceeding normal hottest-coil temperatures.

In Fig. 3 the curves indicate the relation between

the reactive and direct-current loads of a six-ring converter for various power factors and in addition the limiting loads for 100 per cent and 200 per cent of normal loading.

Consequently these curves give the limiting values of the reactive load which the converter may develop simultaneously with any particular direct-current output, according to whether the limit is considered to be due to the average or to the hottest coil heating equivalent either to direct-current rating or to a direct-current overload of 41 per cent at 100 per cent power factor. It will be seen that the total load which may be carried is determined roughly by the arithmetical sum of the direct-current load in kw. and the reactive load in kva., instead of being determined by the quadrature sum as is usual in the synchronous motor. The table, taken from the curves of Fig. 3, shows this statement to be true.

Street Lighting— An Undeveloped Source of Revenue

Adequate Illumination of Thoroughfares Presents Big Commercial Opportunity—Comparative Value of Load—Cost Data After One Year's Experience in East Cleveland

By G. E. MILLER
Sales Manager Cleveland Electric Illuminating Company

WHILE there undoubtedly has been an awakening of interest among central-station men in an effort to improve street and highway illumination, the problem has not been attacked from a strictly commercial angle. The initial investment in street-lighting equipment has also been such as to discourage many companies in their negotiations with city authorities. In East Cleveland a plan was worked out whereby the city installed at its own expense the poles, brackets and lamps, while the Cleveland Electric Illuminating Company provided the necessary overhead and underground distribution to lamps, transformers, etc. The details of the plan, together with cost data after one year's operation, were laid before the Sales Managers' Convention at Association Island last July by G. E. Miller, sales manager of the company. Mr. Miller has made a careful analysis of the value of this business to the central-station company and points to a large potential field which has been sadly neglected.

STREET lighting business in general is a field for the sale of central-station service which has been neglected by commercial men. This class of business has not kept pace, in so far as volume is concerned, with general development in the electrical industry.

Lighting the streets of our municipalities by electricity was one of the very earliest extensive uses of central-station service. This development was initiated at a time when none of our companies had even the semblance of a sales department. Street lighting was allowed to drift, and what progress has been made generally followed the lines of least resistance instead of being impelled by the vigorous selling effort which has characterized our development along other lines.

Then, too, there was not the justification for flooding our streets with light in the early days. That was the era of the horse-drawn vehicle and slow-moving traffic, when our streets were still adequate for the purpose of their design. With the passing of years there came a radical change in traffic conditions until today every large city, and even those of moderate size, have traffic problems difficult of solution. With this changed condition and the attendant increase in density of population there has come also an appalling increase in lawlessness and crime at night.

Statistics are now available to prove the value of intensive street lighting as a factor in reducing crime. It is also true that street lighting is beginning to be recognized by municipal authorities as a preventive measure in controlling crime and lawlessness. Aside from conditions in the congested areas of our cities, to which this applies in particular, there is the outlying highway, which owing to darkness at night presents a problem almost as serious.

For the lack of aggressive sales effort the improvement in quality of street lighting has not kept pace with the advance in the lighting art. Unlike the case of industrial and commercial lighting, improvements in the efficiency of light production accomplished by the high-power gas-filled incandescent lamp have in street lighting very largely gone into a reduction of the wattage rather than toward providing higher levels of lighting with the same or greater wattage. This would have been logical had the quantity of light supplied originally been ample, which it was not.

It is not too much to say that wherever the requirements have been studied on a sound engineering basis the conclusion has been that from three to ten times the amount of light now in use on the average is necessary and should be provided. This would mean that instead of an average spacing of 500 ft. or 600 ft. between lamps, as is now common (eliminating limited "white way" areas in business districts), there should be a lamp for each 150 ft. or 200 ft. of street, at least in residential sections, with a minimum consumption of 200 watts per lamp. For important streets or thoroughfares larger lamps, say 500 watts in size, are needed, and when these are placed on each side of the street in accordance with good practice, there is a minimum of one such lamp for every 100 ft. or 150 ft. of street—fully ten times the wattage so often found in the present sadly underlighted condition.

In considering the desirability of a street-lighting load as compared with other loads there are a number of factors which are worthy of note.

Street lighting is a fixed load throughout a contract period of from five to ten years. Its revenue is assured through periods of industrial depression as well as of prosperity. Rarely are there any bad debts or loss of revenue. This does not hold true for many power applications and other forms of lighting.

Street lighting operates usually as an all-night load of 4,000 hours, or an average of eleven hours a day. While it may include the evening peak, it also ranges through the midnight to morning valley in the load curve.

The revenue per connected kilowatt in street lighting is especially high in comparison with other forms of load. The following illustrative comparisons may serve to picture this a little more clearly:

A street lamp of 200-watt size consumes 800 kw.-hr. a year at a revenue for energy alone ranging from $20 a year upward. As a current-sales revenue producer, therefore, a single 200-watt street lamp is fully equal to:

(a) A residence customer with a large connected load of lamps and appliances, requiring meter reading, billing, connecting, disconnecting service, etc. The average residence customer returns a total of only $18 to $25 per year. The average for the United States is probably around $20.

(b) The installation of additional home-lighting fixtures taking a total of forty 50-watt lamps or 2 kw. connected. Surveys have shown that the average hours per day usage

COST DATA FOR EAST CLEVELAND INSTALLATION

Investment Cost for 115-Volt Multiple "Mazda" System—Cost per Lamp*†

	Labor	Material
Conduit	$31.43	$12.02
Lead cable No. 12	8.87	10.08
Poles and brackets (16-ft. and 4½-ft.)	11.53	32.89
Lanterns	2.60	12.33
Time switches	3.30	16.00
Total	$57.73	$83.32
Total investment per lamp by city		141.05
Investment exclusive of time switches—per lamp		121.75

Series "Mazda" System—Investment for Overhead and Underground Distribution to Lamps, Transformers, etc.*

	Labor	Material
Poles and brackets (20-ft. and 6-ft.)	$12.30	$41.40
Lanterns (large type)	2.60	13.00
Total	$14.90	$54.40
Total investment per lamp by city		69.30

Maintenance Costs for 115-Volt Multiple Street Lighting†

Number of Lamps	
115-volt, 150-watt (210-cp)	550
115-volt, 200-watt (300-cp.)	20
Total lamps multiple system	570
Repairs to Wiring and Underground Ducts:	
Cable failures first year	0
Cases of breaks or changes due to building excavation work	6
Labor and material to replace total of six approximately	$125.00
Cases of changes of attachment of fuse boxes and wiring made necessary by replacement of old wooden poles by new at rear lot line	25
Labor and material for twenty-five—approximate total	$150.00
Total East Cleveland maintenance cost on wiring and underground ducts	275.00
Average cost per lamp per year	.48
Lamp Post and Bracket Repairs:	
Lamp posts bent or broken through being struck by trucks‡	7
Total material and labor for repairs, approximately	$300.00
Number of cast-iron bases broken	15
Total material and labor for base repairs	300.00
Approximately two-thirds of cost of pole and base damage repair was collected from vehicle owners; East Cleveland cost—net	200.00
Average East Cleveland net cost per lamp per year	.35
Lamp Fixture Repairs—Globes and Refractors:	
Total globe breakage (includes thirty-six cracked globes)	84
Globes cracked or broken per fixture per year	0.15
Globe cost, eighty-four at $2.40 each, approximately	$202.00
Refractor breakage, one only at $3.50	3.50
Total repair cost globes and refractors	$205.50
Average cost per lamp per year	$0.36
Lamp Renewals:	
Rated life in hours	1,000
Average life from records, in hours	1,430
Lamp renewals per lamp per year	2.8
Average lamp renewal cost per lamp per year:	
150-watt (210-cp.) ($2,500 contract), at 0.71 cent, approximately	$2.00
200-watt (300-cp.) ($2,500 contract), at 0.92 cent, approximately	$2.60
General Maintenance:	
Supervision, painting, renewing lamps and fuses, cleaning, records, etc., including salaries equivalent to one electrician and helper, and miscellaneous supplies‖	$2,800
Share of one Ford truck per year	$360
Total general supervision, maintenance, renewing lamps, cleaning, painting, etc., annually	$3,160
Average cost per lamp per year	$5.55
Total maintenance cost per lamp per year:	
150-watt, 115-volt (210-cp.) underground	$8.74
200-watt, 115-volt (300-cp.) underground	$9.34

*Not including investment of Cleveland Electric Illuminating Company.
†Underground supply via side lot lines.
‡ Several of these were straightened without removal.
‖ City staff to consist of city electrician, one additional electrician and one helper. Regular duties include city electrical inspection and police and fire-alarm system maintenance as well as street lighting. In emergencies extra help is furnished by street department labor and charged by job.

Summary of Annual Costs for Residential System

115-VOLT, 150-WATT LAMPS

Fixed Charge:		
Interest and sinking fund charges on bond investment of city at 9 per cent on $141.05		$12.70
Maintenance:		
Repairs to wiring and underground ducts	$0.48	
Repairs to lamp posts	.35	
Globes and refractors	.36	
Lamp renewals	2.00	
General supervision, cleaning, renewing lamps, maintenance, painting, etc.	5.55	
Total maintenance		$8.74
Electrical Energy:		
Contract for electrical energy and switching		20.08
Total annual cost		$41.52

115-VOLT, 200-WATT

Fixed Charge:	
Same as for 150-watt	$12.70
Maintenance	
Same as for 150-watt except lamp renewals increased $0.60	9.34
Electrical Energy and Switching:	
Contract for electrical energy and switching	22.32
Total annual cost	$44.36

Summary of Operating Costs for Both Residential and Thoroughfare Systems

	150-Watt (210-cp.) Multiple Underground	200-Watt (300-cp.) Multiple Underground	250-cp. Series Overhead	400-cp. Series Overhead	1,000-cp. Series Underground
Fixed Charges:					
Interest and sinking fund on bond investment of city at 9 per cent; multiple, $141.05 (lamp post and underground complete)	$12.70	$12.70	.....	.....	.....
Series, average, $69.30 (lamp post installed)	.....	.....	$6.24	$6.24	$6.24
Maintenance:					
Multiple (estimated from 1922-23)	8.74	9.34	.....	.....	.....
Maintenance and electrical energy supply—series	.....	.....	43.80	55.20	94.80
Electrical energy and switching multiple	20.08	22.32	.....	.....	.....
Total annual cost per lamp to city, including fixed charges	$41.52	$44.36	$50.04	$61.44	$101.04
Number of lamps in system	550	20	125	46	93
Total annual cost to East Cleveland for 834 lamps					$42,210.00

Old System (Cleveland Electric Illuminating Company)

Kind	No.	Lamp Type	Size	Rate	Annual Payment
Electric	130	Magnetite arcs	4 Amp.	$55.20	$7,176.00
Gas	626	.....	25 cp. (approx.)	$20.00	$12,520.00
Total					$19,696.00

New System (Installed 1922)

No.	Lamp Type	Size	Rate	Annual Payment
93	"Mazda C"	1,000 cp.	$94.80	$8,816.40
46	"Mazda C"	400 cp.	55.20	2,539.20
125	"Mazda C"	250 cp.	43.80	5,475.00
550	"Mazda C"	150 watts	20.08	11,044.00
20	"Mazda C"	200 watts	22.32	446.40
834				$28,321.00
Fixed charge on city investment, 9 per cent				8,886.00
Maintenance of multiple lamps by city				5,003.00
Total				$42,210.00

	Old	New
Total number of lamps	756	834
Total candle power of system	70,000	265,000
Per cent increase in candlepower	.....	280
Total annual payment	$19,696.00	$42,210.00
Increase in annual payment for lighting	.....	$22,514.00
Per cent increase in annual payment	.....	114
Payment per capita	$0.70	$1.50

of each lamp in the houses is a little over one hour, or about 400 hours per year, only one-tenth the burning time of a street lamp. Hence, a 200-watt street lamp consumes as much energy per year as 2 kw. connected in residence lighting.

(c) At least forty electric vacuum cleaners or electric washing machines sold to homes. These represent a connected load of about 10,000 watts, but, according to the Society for Electrical Development figures, consume on the average only about 20 kw.-hr. each per year, requiring forty machines to equal the consumption of a single 200-watt street lamp.

Undoubtedly the greatest single deterrent to a more active solicitation of street lighting on the part of central stations has been the very high investment in special apparatus and supply circuits that has been required. The central station has been expected to carry all of this cost, while, on account of the comparatively short-term contract during which the investment had to be amortized, a high rate was necessary to avoid possible loss in case the contract was not renewed, using the same equipment, or its renewal was contingent upon the installation of expensive improvements.

The wide spacings between lamps so commonly adhered to was responsible for still further increasing the investment cost per lamp. This special investment per lamp has run from $100 to perhaps $300, depending upon whether the lamp post consisted of a bracket on wooden pole or was of an ornamental type of construction and whether the supply was overhead or underground.

There are four obvious ways of reducing the central-station investment per kilowatt:

(1) *Higher-Wattage Lamps.*—Fixture, lamp, post and distribution construction is nearly the same for a 500-watt lamp as for a 100-watt lamp.

(2) *Closer Spacing.*—The circuit construction saving at a spacing, say, of 150 ft. as compared with 600 ft. may be very large.

(3) *Adoption of Less Expensive Means of Supply.*—Departures from the old standard arc-lamp circuit, each one of which had to be run back to a substation, may make possible very considerable reductions in special investment cost. In some instances the complete utilization of existing multiple-distribution systems by the adoption of 115-volt multiple instead of series lamps has very favorable possibilities.

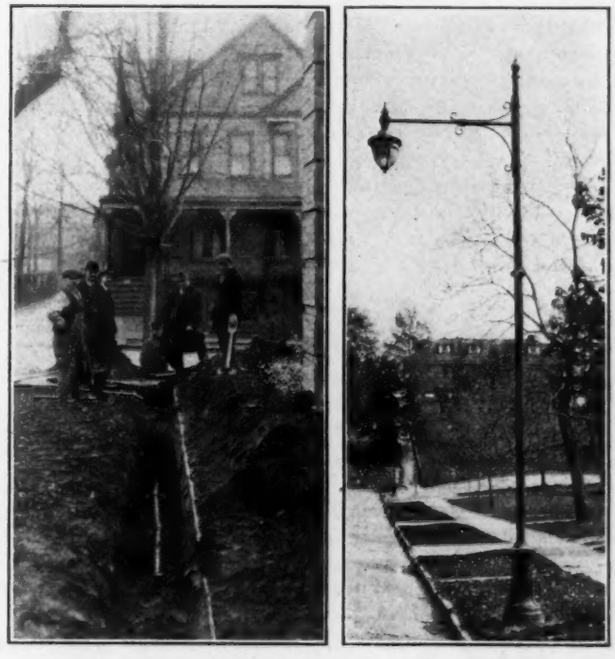
(4) *Sharing Special Investment Cost with City.*—If the city pays for the poles and fixtures and perhaps part of the special circuit cost, the fixed charges on this investment (which sometimes amount to fully one-half the total annual bill for street-lighting service) do not appear in the charge made to the municipality by the central station. The smaller annual charge thus made possible, which then covers cost of energy and service only, is much less subject to misunderstanding or misinterpretation on the part of those who scrutinize municipal expenditures and who are accustomed to consider central-station rates as covering electrical energy only. An annual service rate which includes heavy fixed charges may seem exorbitant to one not acquainted with the circumstances and at the same time actually be below cost.

It should be emphasized that the present average expenditure per capita for street lighting is almost ridiculously low, ranging around 70 cents per capita per year. In other words, the total cost per year for this important service contributing greatly to safety, comfort and convenience is no greater than that of taking the family to a good moving picture show once a year. It is estimated that from $1.50 to $2 per year per capita is the minimum outlay which will provide an adequate system of street lighting. However, the increase in revenue from energy should be considerably greater than indicated by the difference between 70 cents and $2 because in a properly designed system a much higher proportion of the increased outlay should go into a greater total of wattage rather than into increased fixed charges.

NIGHT VIEW OF STREET BEFORE AND AFTER NEW LIGHTING SYSTEM WAS INSTALLED

Street lighting is a service which is in no sense competitive with any other service supplied by the central station; in fact, it is common experience that a higher level of street lighting contributes materially to an increased development of commercial, industrial and residential lighting loads. It is fair to claim that real estate is worth 10 per cent more on a properly lighted street than on one that is poorly lighted.

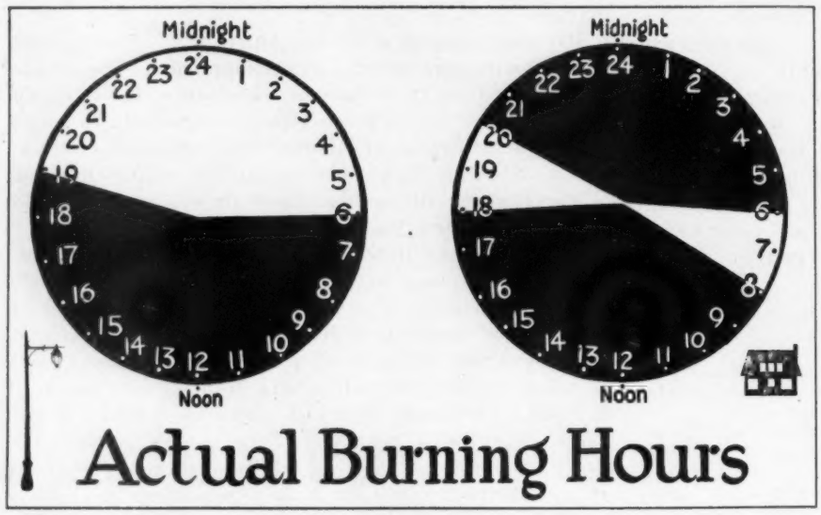
An interesting illustration of what may be accomplished in the way of better street lighting with the proper application of combined sales and engineering effort is the installation in the city of East Cleveland. East Cleveland is a suburb of 28,000 inhabitants, with 39 miles of paved streets and a total street length of 42 miles. Previously this city was served with 120 arc lamps, bringing a revenue to the central station annually of about $7,200. In addition there were about 600 gas lamps, so that the total expenditure of the city for street-lighting purposes came to approximately $19,000 annually. Thus the expenditure was very nearly the country-wide average of 70 cents per capita.



LEFT—TYPICAL UNDERGROUND CONSTRUCTION USED IN RESIDENCE DISTRICT. RIGHT—TYPE OF RESIDENCE STANDARD USING 150-WATT GAS-FILLED LAMP

During the past year in the above city there was placed in operation an entirely new lighting system consisting, in the residential district, of twenty 200-watt (300-cp.), 115-volt multiple "Mazda" lamps and 550 150-watt (210-cp.), 115-volt multiple "Mazda" lamps, and in the thoroughfares of ninety-three 1,000-cp. "Mazda" series lamps, forty-six 400-cp. "Mazda" series lamps and 125 250-cp. "Mazda" series lamps. The total number of lamps in the new system was thus 834.

The lighting installation as designed called for a complete multiple system. However, in order to take advantage of series lines already in place on certain thoroughfares, series-type lamps were used for these streets. The total candlepower supplied by this new system is approximately 265,000, as compared with 70,000 cp. for the old system. The total cost to the city, including all maintenance and fixed charges on the new lighting system, was estimated at $45,000, of which a payment of approximately $28,000 represents the annual central-station revenue. The cost to the city for the first year was actually not much over $42,000, since repairs—as might be expected—were low during this period.



WHITE SPACE SHOWS COMPARATIVE AVERAGE DAILY BURNING HOURS OF STREET LAMP AND RESIDENTIAL USER

The total connected load of the 570 multiple lamps in the residential system is approximately 87 kw., which brings a revenue of $11,600 annually, or about $133 per kilowatt connected. The total connected load for East Cleveland streets, including both multiple residential and series thoroughfare lighting, is about 169 kw. hours. The rates are as follows:

1,000-cp. underground series	$94.82
400-cp. series overhead supply	55.20
250-cp. series overhead supply	43.80
200-watt, 115-volt (300-cp) (current and switching only)	22.32
150-watt, 115-volt (210-cp.) (current and switching only)	20.08

The city of East Cleveland furnished and erected all ornamental poles and fixtures. The central-station company installed the circuits and transformer supply for the series lamps (1,000, 400 and 250 cp.), and it supplies a complete electrical energy, lamp renewal, maintenance and repair service throughout the period of the contract for these series lamps. In the case of the 150-watt and 200-watt multiple lamps which are used on residential streets, East Cleveland not only erected the lamp poles and fixtures but also installed the underground supply and purchased time switches for controlling them. Bond issues totaling $102,000 were made by the city to cover its share of the investment. The city maintains the multiple-lamp posts, furnishes lamp renewals, repairs breaks in the supply circuits, etc. In other words, at the rate shown for the multiple lamps the central-station investment consisted only of connecting the lamp loops to the nearest existing pole of the secondary distribution system, and under the contract the central station is held only for the supply of current at 115 volts, including the connection of and the winding and maintenance of the time switches.

A detailed summary per lamp of the installation cost of the multiple lamps on residential streets, borne by the city, is shown in the accompanying tabulations. Two articles entitled "Improved Street Lighting that Assures Greater Safety to Traffic" and "Multiple Street Lighting Favored," published in the ELECTRICAL WORLD of July 29 and Aug. 26, 1922, give detailed descriptions of the various technical features of the installation.

Among the advantages which apply to 115-volt multiple supply under the conditions of this installation are the following:

(1) Central-station investment is exceedingly low compared with the usual practice.

(2) The standard secondary distribution system already in place and serving the territory is used and the duplication involved in running a separate series distribution system is avoided. A high-tension series street-lighting circuit operating at 6,000 volts carries a maximum load of about 40 kw. as supplied with a separate regulating transformer panelboard, etc. A standard three-phase lighting circuit of the same voltage and costing but little more for pole construction per wire has a capacity upward of 500 kw.

(3) The city is enabled to supply the type of lamp post and equipment which is desired, and the expense of this equipment does not enter into the central-station rate for supplying service.

(4) The multiple lamps are tied into central-station secondary distribution systems at several hundred different points, thus diversifying this load over the whole secondary system.

(5) Very little disturbance of the existing secondary system is involved. The additional load per secondary from a 150-watt or 200-watt lamp for every five to ten residences is very small. In fact, in East Cleveland no immediate transformer changes were necessary in any part of the city upon connecting the street lamps.

(6) The street-lighting load improves the average load factor upon the secondary distribution system. The annual load factor of this added load is 45.6 per cent.

I do not mean to imply that no progress has been made in street lighting, for we all know of excellent installations of "white way" lighting, and there are isolated examples of fair highway lighting installations. But they are all too few. What I wish to emphasize is that here is a large potential field for the use of central-station service which we, whose duty it is to sell this service, have neglected. Traffic conditions have brought about a demand; the time is right to go after it; equipment is available to produce satisfactory results—now it is up to us to sell it. If this is put on a commercial basis, there is no reason why the central-station company cannot obtain a large volume of profitable business.

Interconnection and Transformers

Group Operation of Interconnected Systems Having Different Frequencies Has Been Successfully Accomplished by Using Frequency Changers—Tests and Discussions of Transformers Having Tertiary Windings

AT THE recent convention of the A. I. E. E. at Del Monte, reported in the ELECTRICAL WORLD of Oct. 20, several papers of great interest were presented covering the practices and experiences of California companies. In southern California the group operation of high-tension transmission systems having different frequencies has been successfully accomplished by the use of rugged frequency changers. This development is a pioneering effort that should permit companies in other localities to profit.

Another phase of development in the transmission art very successfully carried out in California involves the extensive use of transformers having tertiary windings. Data and experiences were splendidly presented at the convention and the problems yet to be solved were clearly indicated. The following abstracts cover the chief features of the subjects discussed at the convention:

Operating Interconnected Systems of Different Frequencies

SOUTHERN California has a group of interconnected transmission systems which operate as interconnected units, although the system frequencies differ. This operating condition was described in a paper by E. R. Stauffacher and H. J. Briggs.

The position of the Southern California Edison Company is unique in that it is, with one exception, entirely surrounded by systems operating at a different frequency. The above company interchanges power with the San Joaquin Light & Power Corporation (60 cycles) on the north, the Southern Sierras Power Company (60 cycles) on the east and the San Diego Consolidated Gas & Electric Company (60 cycles) on the south. In addition to this there is an interchange of power between the systems of the city of Los Angeles and the Southern California Edison Company, but without the necessity of frequency changers as both systems operate at 50 cycles. To be more specific concerning the location and size of the various frequency changers, these data are given in Table I.

To give an idea of the value of group operation of a number of systems through frequency changes, Table II has been prepared showing the amount of power interchanged during the past year.

From a study of this table the flexibility of frequency changers as a means of interchanging power is well shown. In addition to delivering power from one company to another, the equipment can obviously be utilized as a means of delivering power to a third company.

It may be of interest to outline the method of metering when power is to be transmitted in either direction through a frequency changer. The scheme generally used is to have both sides of the machine equipped with a polyphase curve-drawing wattmeter and two polyphase integrating watt-hour meters. Each of the integrating instruments is equipped with a ratchet mechanism so arranged that one instrument will meter energy only when power is flowing toward the frequency changer while the other will register only when power is flowing from the machine.

In regard to the protection of the frequency changer, time-limit overload relays have been used on both ends, so that in case of trouble on either system the frequency changer is disconnected on the side of the system in trouble. Power directional relays can be used to good advantage for this purpose. In addition to this it is necessary to provide some means of protection against internal trouble of the frequency changer, and this has been provided for at Vestal by means of two sets of power directional relays so wired that their contacts are closed when power is going toward the frequency changer. In addition to this the contacts on each set of relays are wired in series, so arranged that the tripping circuit will kick out the switches on both sides of the frequency changer. Under these conditions it can be seen that power will flow toward the frequency changer from both sides in case of a severe ground developing in the machine, and it is hoped by this means to keep the damage to the machine windings and laminations down to a minimum.

In conclusion it was stated that the frequency changer had proved to be a very satisfactory means of interchange of power, and that it should cause no trouble provided it is of the proper size in relation to the two systems which it connects. In addition to its value as a means of interchanging power the frequency changer set may be used for power-factor correction when necessary.

TABLE II—POWER INTERCHANGE (KW.-HR.) THROUGH FREQUENCY CHANGERS

Month	Purchased and Delivered by Company B to Company A Substation No. 1	Substation No. 2	Delivered by Company C to Company A	Purchased by Company D from Company A
January	100	1,850	0*	571,300
February	0	0	4,492,800	1,070,700
March	0	127,150†	604,800	1,799,850
April	0	0	99,000	3,184,300
May	8,150	1,350*	0	2,798,200
June	1,750*	0	41,400	2,767,200
July	342,500‡	1,462,850	19,800	1,957,500
August	24,700‡	211,050‡	5,079,600	2,192,900
September	.....	19,750	7,619,400	1,910,700
October	.....	450	8,499,100	1,749,300
November	.....	300	6,080,400	1,558,700
December	120,050	137,550	5,337,000	1,400,800

* Purchased by Company A.
† Received for transfer to Company D.
‡ Part received for transfer to Company D and part utilized by Company A.

TABLE I—SYSTEMS INVOLVED AND FREQUENCY CHANGERS USED

Connection Between	Size of Unit Kw.	Power Factor	Voltage	Location of Unit
Southern California Edison Company (50 cycles) and Southern Sierras Power Company (60 cycles)	5,000	0.8	11,000 (50 cycles) 6,600 (60 cycles)	Southern California Edison's Colton substation
Southern California Edison Company (50 cycles) and Southern Sierras Power Company (60 cycles)	5,000	0.8	11,000 (50 cycles) 6,600 (60 cycles)	Southern Sierras' San Bernardino steam plant
Southern California Edison Company (50 cycles) San Diego Consolidated Gas & Electric Company (60 cycles)	5,000	0.8	11,000 (50 cycles) 6,600 (60 cycles)	Southern California Edison's Capistrano substation
Southern California Edison Company (50 cycles) and San Joaquin Light & Power Company (60 cycles)	15,000	0.8	15,000 (50 cycles) 18,000 (60 cycles)	Southern California Edison's Vestal substation

Auto-Transformers with Tertiary Windings

MOST of the major companies using high-tension systems in California have adopted a permanently grounded neutral on the high-tension circuit and a considerable number of the later-built transformers have been auto-transformers, designed specifically to operate only with one terminal of the high-voltage winding grounded.

In present designs some of the tertiaries used to suppress harmonics have a current density 20 per cent higher than the primary of the same transformer for the name-plate rating. This relatively high resistance further increases the tertiary temperatures under short-circuit conditions. Having this condition in mind, it becomes an operating problem of when and how to protect the tertiary winding against destructive overheating during line short circuits, and a paper was presented by J. Mini, Jr., L. J. Moore and R. Wilkins.

Tertiary windings are used, in addition to the prevention of inductive interference, for:

1. Providing a path for the third harmonic current necessary for the proper magnetization of the core for a sine wave emf. across the main windings.

2. Stabilizing the neutral and providing a sufficient flow of current in the line or windings at times of single-phase short-circuit conditions to give proper operation of relays and circuit-breakers.

3. Providing a winding for load connections or a synchronous condenser.

In practice the size of the tertiary is fixed by the short-circuit kva. rather than the third harmonic component of magnetizing current; i. e., this winding must carry the short-circuit kva. long enough to allow circuit-opening devices to operate. The time required to open the circuit is usually short, of the order of five seconds or less, and therefore very little radiation of heat takes place; consequently the copper must store its I^2R losses by thermal capacity during this period.

For short-circuit conditions the size of the tertiary is determined by the value of short-circuit current that is desirable for protective reasons and by the duration of the heavy current.

From 300 to 400 per cent of normal current is usually desired for operation of protective relays, and this abnormal current requires a tertiary winding constructed to have from 25 to 30 per cent of the capacity of the main transformer windings.

The reactance in the tertiary circuit is then made such as to limit the current to the above values for the voltage applied to a short-circuited transformer.

It is unsafe to use less reactance on account of danger from burn-out and not wise to use more because the amount of the short-circuit current desired would not be obtained.

The kw. capacity and reactance of the tertiary are interdependent and with one value given the other is fixed.

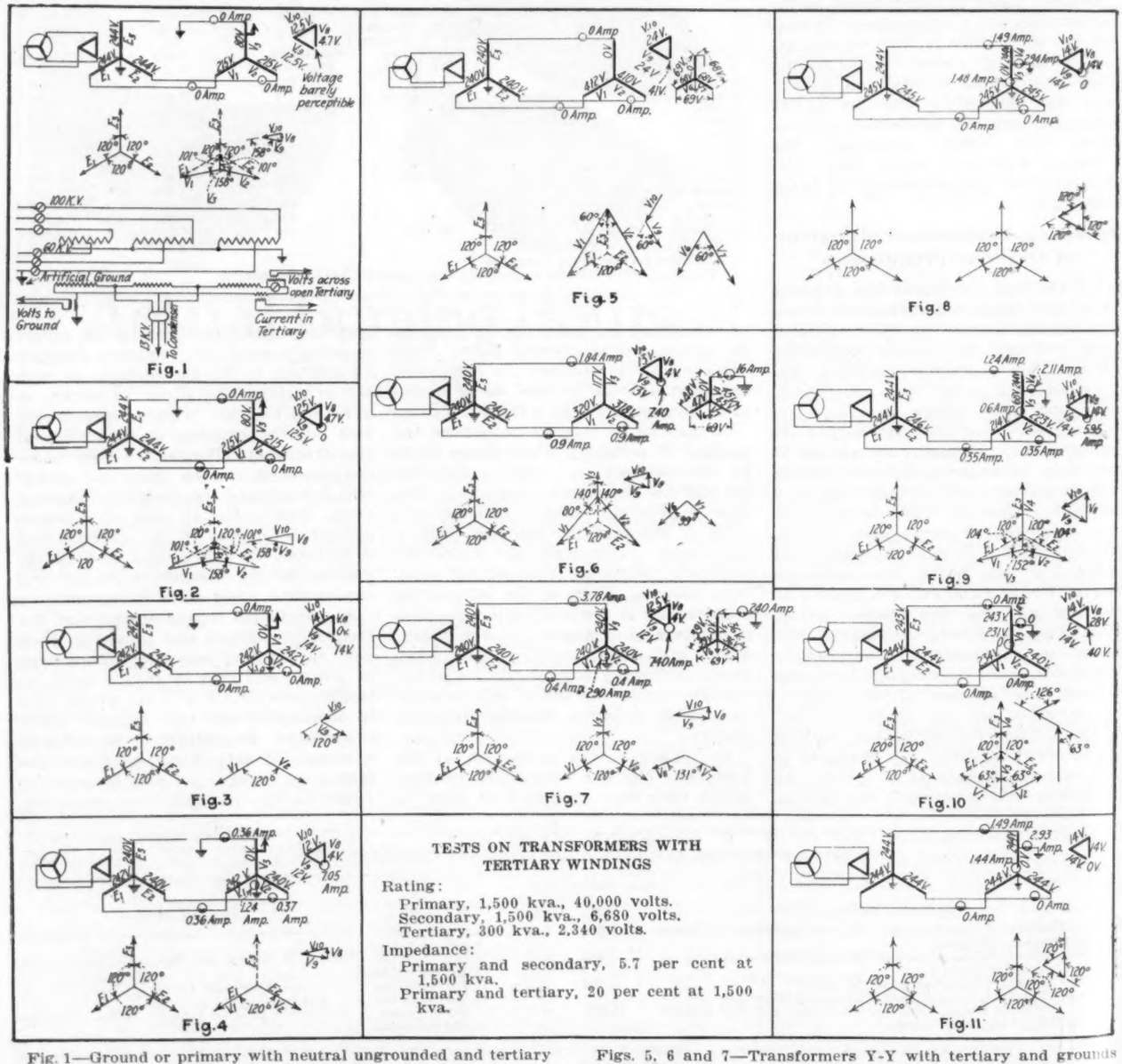


Fig. 1—Ground or primary with neutral ungrounded and tertiary closed.
Fig. 2—Same as Fig. 1 with tertiary open.
Fig. 3—Neutral grounded tertiary open and Fig. 4, closed.

Figs. 5, 6 and 7—Transformers Y-Y with tertiary and grounds on secondary.
Figs. 8, 9, 10, 11—Conditions with transformers connected as auto-transformer with a tertiary. Tap is in exact center of primary.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Bridging the Gap Between Pure Science and the Business of Industry

To the Editors of the ELECTRICAL WORLD:

Professor Karapetoff's letter in your issue of July 7 puts very concretely the thought that the men who are working on research, or, as Professor Karapetoff says, "working for unborn generations," feel that the men who are engaged in today's problems in the engineering and business world show an utter lack of interest in their work. Another phase of this same lack of appreciation of the kind of thinking that is essential if we as an American nation are to succeed to the heritages of the past has been lately expressed by a professor of English, who has stated that the only way a teacher can win recognition these days is to forget that he is a teacher and write articles outside of his work which will bring him into enough prominence to make his individuality apparent to boards of trustees and to others interested in the promotion of education in our country.

What can be done to vitalize and make dynamic in the minds of the rank and file of engineers and business men the need of pure research and the need of true teachers? One simple thing we may all do is to bring these two very closely allied questions in our engineering education to the forefront and to promote discussion of them before the fine faith and the splendid enthusiasm for research of a small and devoted group of men ends in tragedy. Not all men are fitted to teach and probably fewer still have a genius for research. When such a one is found the best all of us can do is to promote in every way possible his opportunity for service.

One of the problems of promoting these opportunities for service seems to me to lie in the fact that few of those who know that it should be done are attempting to bridge the gap between pure science and the business of industry. We are so busy carrying out commercially today the things that Faraday and Helmholtz and others did for us before we were born that we do not take time to think of the men who must be doing that same sort of thinking if our children's children are to inherit the things that are of the intellect and of the mind, as well as the material prosperity earlier discoveries have given us.

Pure research and every-day work are so far removed from each other that it is very difficult for either group to meet with a common understanding. What we need is a group of interpreters—men who will emphasize at every opportunity the place of pure research and the place of true teaching in our present industrial life. We need regularly to review the research now going on in our industry. We must see it as a whole by bringing together the separate entities, so that each man in research will know that he is really working with a larger group. The total pool of our research activity, which, after all, is relatively small, must appear in a new perspective to those of us workaday folk who have learned to subsist upon the superlative and who therefor fail to comprehend at times the true superlative in the painstaking, cloistered effort of the small minority who are at work now for our children's children.

Society for Electrical Development,
New York, N. Y.

F. M. FEIKER,
Vice-President.

Young Engineers and the Seven-Day Week

To the Editors of the ELECTRICAL WORLD:

I have read the brief rebuttal by "A Young Engineer" to an editorial in the Aug. 4 issue of your paper, and I should like to say that our "Young Engineer" certainly derived the wrong idea from the editorial. Young engineers are needed for power-house operation, not in the coal bunkers or on the headgates, nor at the throttle, but in charge of the plants, with their minds alert and clear to grasp new ideas and situations and to direct operations, repairs and construction along modern economical engineering lines. In order to do this the young engineer must spend his seven days a week for some time with overalls on so as to familiarize himself with operating conditions, the conditions which his future operators will be up against at either 2 a.m. or 2 p.m. Then, having met with and overcome these conditions, he is in a far better position to supervise.

There are a multitude of operators who simply thrive on power-plant operation seven days a week. They are cut out for such work and, while they are experts in the trade, they unfortunately have not had the education to go further. These men are not to be pitied but rather looked up to as men who are industrious, sturdy and trustworthy and big assets to the electrical industry.

It would appear that our "Young Engineer" has spent time enough in actual plant operating, and his three years' experience should prove of great value to him, and he should be on the lookout for a better position, provided there is nothing in his present position that he cannot master. If such is the case, he with his education would be very valuable to any operating company directing other operators and operations. Should he reach this point and be thoroughly interested in his work, he will not find routine or grind but hundreds of interesting problems confronting him. He will be glad to work seven days a week.

If our "Young Engineer" were more experienced, he would not advocate a six-day week, for reasons which he will learn later, and as he grows older he will find that there are objectionable features about every position which have to be endured with a smile.

AN EXPERIENCED ENGINEER.

German Switching Practice

To the Editors of the ELECTRICAL WORLD:

I was very much interested in the description of German switchgear pictured in the Sept. 29 issue of the ELECTRICAL WORLD. The practices and the equipment differ very radically from those used in this country, and American engineers will question the use of the type of current transformers illustrated because of sad experiences with mechanical failures under heavy short-circuit conditions. The use of floor instead of ceiling mounting for the buses and disconnecting switches on 110-kv. circuit is, in my opinion, less safe and less serviceable construction. The angle-iron mounting of buses on top of cross girders, however, appears feasible and good practice. It may be that in stations using the equipment and the type of construction shown the load is small in comparison with conditions in this country.

A POWER PLANT ENGINEER.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Two-Intensity Substation Lighting System

While Regular Operation Can Be Performed with Low Intensities, This System Affords High Intensity Whenever Needed for Emergency and Construction

BY E. D. TILLSON
Testing Engineer Commonwealth Edison Company, Chicago

FREQUENTLY occasions arise where the most rapid and accurate discrimination is required in generating stations and substations and where failure of judgment may mean a great loss of property or time or may bring injury to those in the station. In sudden emergencies, at times when repairs, alterations or additions are under way, and in the discharge of such duties as phasing out, grounding circuits, pulling clips, setting and checking relays, adjusting circuit regulators, etc., quick decisions must be made, and as an aid to them the very best lighting is imperative.

Since the eye, when previously accustomed to moderate interior illumination, functions accurately in the neighborhood of 3½ ft.-candles, one might conclude that if the substations were laid out for an average illumination of this value all purposes would be served. But this is far from being the case, because the shadow ratio for direct lighting of a substation interior lies in the neighborhood of from ten up to twenty to one. In other words, if an object is in clear light, the illumination may be in the neighborhood of 3 ft.-candles, but if it is in shadow, then the illumination dwindles to 0.15 or 0.3 ft.-candle, which means groping in semi-darkness.

Nearly all of the most important parts of a substation are cast in deep shadow; for example, both the high-tension and low-tension clips and switch mechanisms, the relay mechanisms, instrument transformers, pendulum switches, regulator mechanisms, etc. The result is that operators or others who must work on the apparatus are compelled either to use flashlamps or drop cords or else simply work without additional light. All three ways are dangerous. Attention has many times been called to this condition by operators, testing and construction men.

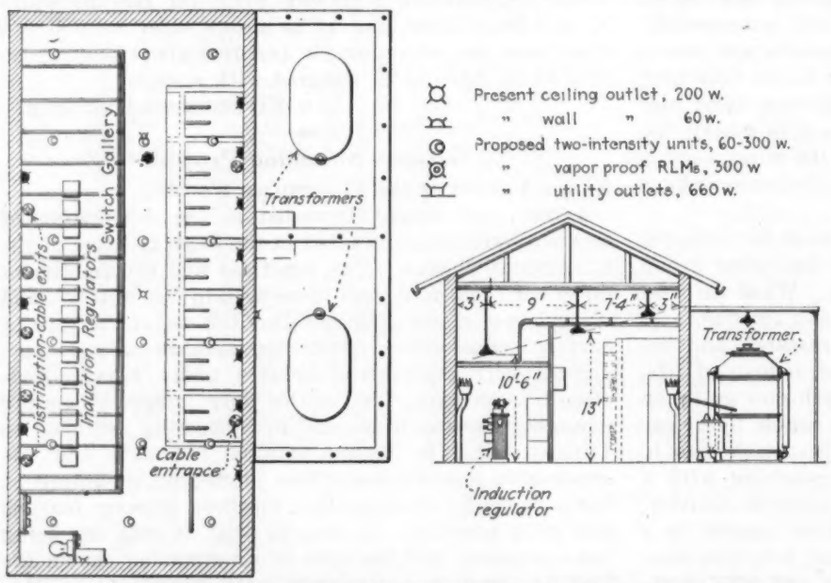


FIG. 1—DUAL LIGHTING SYSTEM FOR SUBSTATIONS PROVIDES HIGH INTENSITY WHENEVER NEEDED BUT KEEPS FIXED CHARGES LOW

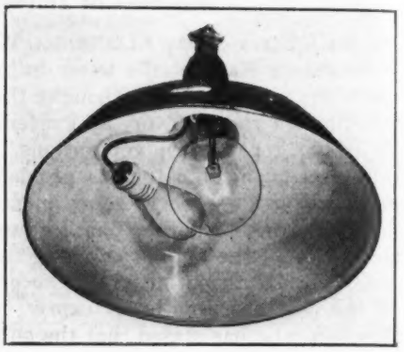


FIG. 2—COMPLETE ASSEMBLY OF TWO-INTENSITY LIGHTING UNIT

The question, then, is, how shall special operations be carried out quickly and safely? With any feasible plan of substation lighting it is impossible to get rid entirely of the shadows, but there is one thing that can be done. A great deal of reflected light can be thrown into the dark pockets, thus raising the illumination within the shadow to a point where small objects may be readily discerned, such as the hook hole in the clip. The only method of accomplishing this is to provide such a surplus of light originally that all objects surrounding the recesses will be strongly lighted. The reflected light from these objects will then enter the recesses at various angles and create sufficient illumination to permit of fine work without flashlamps, even though the place be at some distance from the primary source of light.

It would certainly be a waste of energy to keep such lighting in service except when there is a real need. As a matter of fact, the psychology of the average operating man would absolutely prohibit it. Hence the writer suggests that lighting equipment which provides alternative illumination be installed—first, a low intensity for routine care of stations about equal to the present, and, second, a value of fifteen times this figure for all occasions of special or emergency work. An illustration of this equipment for a 60-cycle substation is shown in Fig. 1. The luminaire

carries two light sources—a 60-watt type B white-spray enamel lamp and a 500-watt type C clear. Both are housed in a standard 300/500-watt "RLM" reflector (Figs. 2 and 3). It is therefore seen that there is no duplication of fixtures or outlets.

Virtually the only added expense

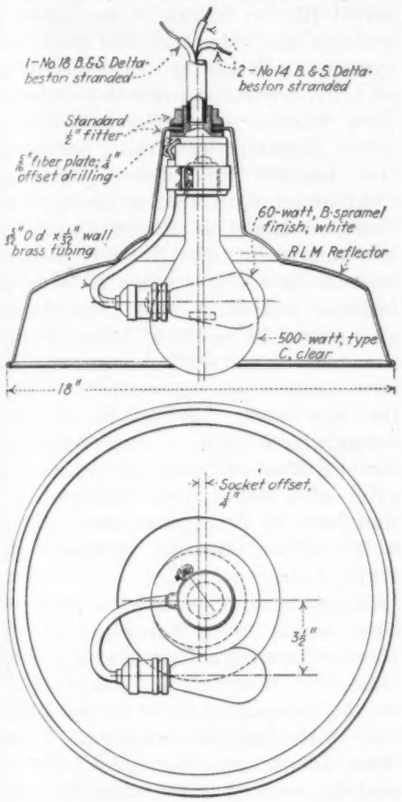


FIG. 3 — TWO-INTENSITY LIGHTING ARRANGEMENT FOR SUBSTATIONS USES THE REGULAR STANDARD "RLM" REFLECTOR

is the third wire and a somewhat larger reflector with a gooseneck and an extra socket. So far as the luminaire itself is concerned, any contractor with ordinary ingenuity should be able to make it up. The number of branch circuits might need to be increased, depending upon local rulings as to maximum circuit capacity. The branch circuits would run back to regulation panel boxes, each circuit being provided with a "1-2-off" snap or its equivalent.

With a scheme of this kind it is desirable to mount the units fairly close to the walls wherever feasible and to paint these walls white from the line of the eaves down to a point approximately 3 ft. below the edge of the reflector. The concrete barriers, steel work, regulator and transformer casings, etc., should be painted white or a light gray wherever possible. All of these factors add to the reflected light upon which the system rests.

For a substation of the type illustrated it has been computed that the special lighting would be used 200 hours per year for one-third of the equipment provided and would consume 660 kw.-hr. per year; that is, it would add only $10 to the equipment tied into the station and that may be affected by its failure to operate properly. The smallness of this expense is most evident when it is considered that the payroll of a construction gang working in this station would probably run to $10 or more per hour and that poor lighting may waste many hours of the time of these men on a single job. This takes no account of accidents or of mistakes that may be made by men working in an underlighted station. The 500-watt lamps should serve about ten years without burning out, while the regular lamp expense should be no more than it is now. The expense of putting in a two-intensity lighting over a similar single-intensity system with "RLM" reflectors would amount to approximately $200 per station.

Small Feed-Water-Treating Equipment for $100*

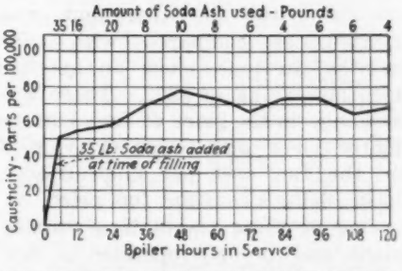
C. B. OLIVER

SMALL plants are usually left to devise their own schemes for keeping their boilers clean. The method of treatment described below is being used in three plants and will be referred to as the "inside" method. It can be installed for approximately $100 and operated more cheaply than an outside treatment plant. The first step to be taken is to have an analysis of the water made by a competent chemist and prevent undertreatment allowing scale formation or overtreatment and the resultant foaming action. Chemicals for simple daily tests will be supplied by the chemist. From data compiled after a few weeks' operation charts similar to those shown in the accompanying illustration can be made for a guide.

The material needed for constructing an "inside" treating plant consists of a 50-gal. steel barrel, a line connecting the barrel to the suction of the boiler-feed pump, a supply of soda ash (58 per cent light) and a water-testing outfit. The soda ash is mixed with hot water in the container and fed slowly throughout the day through a ¼-in. petcock into the line to the pump suction. The solution should never be fed into the heater as the precipitation which takes place would soon foul the heater. There are three requisites for the successful operation of this system, namely: (1) Test the boiler water twice daily; (2) blow a quantity of water from the boilers periodically without fail, two to five times daily; (3) feed chemicals regularly in small quantities.

The constant precipitation of the scale-forming salts causes a sludge to accumulate in the rear header, and if not blown down, it backs up into the lower rows of tubes, and the results are bagged or blistered tubes. For example, suppose a water supply carries 200 parts per million of hardness and the boiler evaporates 2,000 gal. of water per day. This would mean that about 3 lb. of sludge would be formed in a day. This shows conclusively why frequent blowdowns are necessary if this method of treatment is to be used.

The amount of water necessary to be blown from a boiler requiring principally soda ash for softening is much less than that for water requiring principally heat for softening. The blowdown in the first case is governed by the rapidity and completeness with which the solid residue precipitates, and it requires only an appreciable small blow to expel, whereas with water of the latter type large and expensive blowdowns are necessary as the precipitation is very incomplete. The larger portion of the solid residue is held in suspension, necessitating a large amount of the water in the boiler to be blown


Amount of Soda Ash used - Pounds
35 16 20 8 10 8 6 4 6 6 4
Causticity - Parts per 100,000
100
80
60
40
20
0
35 Lb. Soda ash added at time of filling
0 12 24 36 48 60 72 84 96 108 120
Boiler Hours in Service

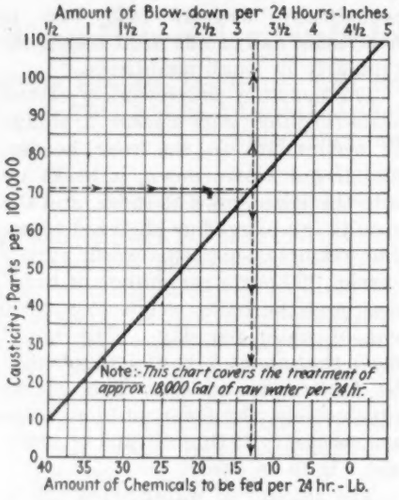
CURVE SHOWING RISE AND DAILY AVERAGE OF CAUSTICITY FOR FIVE DAYS AFTER WASHING 500-HP. BOILER

in order to keep the concentration down.

When using the "inside" treatment, the precipitation starts immediately when the water enters the boiler (if a Heine boiler, when it enters the mud drum), but not all of the precipitate settles in the rear header. A portion of it remains in

*Abstract of paper presented at the Southwest Geographic Division, N. E. L. A., convention at Oklahoma City, March 14-16, 1923.

circulation, being as fine as powder and the amount increasing with time after a blowdown. When the steam leaving the boiler becomes slightly moist, it is possible that some of the finer precipitated matter will pass over into the turbine or engine with serious results. When trouble of this nature is experienced, the number of


Amount of Blow-down per 24 Hours-Inches
½ 1 1½ 2 2½ 3 3½ 4 4½ 5
110 100 90 80 70 60 50 40 30 20 10 0
Causticity-Parts per 100,000
Note:-This chart covers the treatment of approx 18,000 Gal of raw water per 24 hr.
40 35 30 25 20 15 10 5 0
Amount of Chemicals to be fed per 24 hr.-Lb.

AMOUNTS OF BLOWDOWN AND CHEMICALS REQUIRED IN TWENTY-FOUR HOURS TO INCREASE OR DECREASE CAUSTICITY

blowdowns should be increased and the water level in the boiler maintained at about one gage in the boiler.

At the time the treatment was started at one plant scale formed in the tubes at the rate of ⅛ in. in four weeks. This would increase the fuel consumption approximately 9 per cent. According to this, the average monthly fuel bill of $3,000 could be reduced $270. The actual fuel-cost figures taken from reports for seven months after the treatment was started, as compared with nine months previous, show an average monthly saving of $292. There was a change in the price of fuel, but the figure given above was determined on the fuel cost per kilowatt-hour basis, using a constant fuel price.

One of these plants is a standby plant and is only operated a few hours or days each month. The rest of the time only one boiler is kept banked; therefore it is not possible accurately to determine the saving effected in this plant.

The only difference between the treatment at the third plant and at the others was that caustic soda was used instead of soda ash. This was due to the fact that this water was made up mainly of bicarbonates and the chemist therefore recommended caustic soda. Actual fuel-cost figures in this plant for nine months previous to starting the treatment as compared with seven months under the treatment show a saving of $95 per month.

Cost of Substation Equipment

IN THE accompanying table are given various items from the cost sheets of a large New England central-station company covering work done or equipment purchased for substation service during the past few years. In most cases the figures cover the total cost of purchase and installation.

ITEMIZED COST DATA OF SUBSTATION EQUIPMENT

One seventy-five-lamp mercury-arc rectifier, 6,600 volts alternating current to 6.6 amp. direct current, complete with four-tube equipment, with lightning arrester and transfer bus connections	$2,670.73
Building work in connection with above	455.00
One seventy-five-lamp mercury-arc rectifier, 13,200 volts alternating current to 6.6 amp. direct current, complete with four-tube equipment, lightning arrester and transfer bus connections	2,863.38
Replacing three 200-kw. transformers with one 1,500-kw., three-phase transformer and making necessary changes in instrument equipment; installing knife switches for lightning arresters and cartridge fuses for 13,200-volt potential transformers	7,383.98
Installation of one 2,000-kva. rotary condenser, 600 volts, three-phase, 60 cycles, with switching and instruments complete	11,259.18
Installation of synchroscope with lamps on bracket on 13,800-volt switchboard, connecting with upper and lower bus potential transformers through fuses and double-pole knife switches	112.94
Building construction expense in connection with installation of one 1,340-kw. storage battery complete with control equipment	3,624.43
Cost of one 1,340-kw. storage battery complete with control equipment	91,640.89
One 12-kw. motor-generator set with switching equipment for charging separate battery cells	2,336.03
Cells, wiring, switches and instruments for two No. 4/0 split-conductor, 15,000-volt lines	8,400.00
Jumper bayonets for ten 4,000-volt circuits	750.00

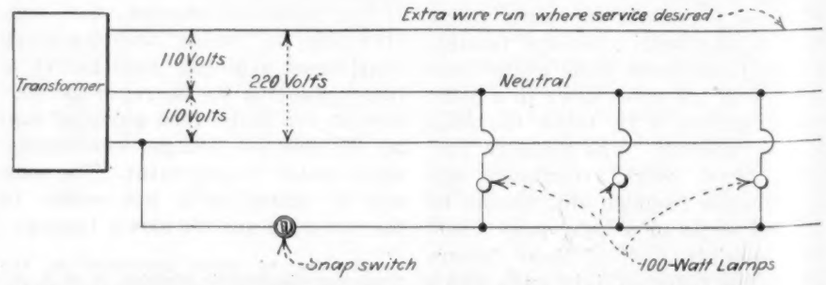
An Inexpensive Street-Lighting System

BY J. W. WALKER
Operating Superintendent Traction, Light & Power Company, Anderson, Ind.

THERE are many small communities in the Middle West that would like to install street-lighting systems did they not feel that the equipment is far too expensive for an unincorporated town to purchase. This feeling has often prevented these communities from receiving the benefits of street lighting. Confronted with this difficulty, the Traction Light & Power Company has adopted a novel but simple system to light the streets of several Indiana towns of 300 inhabitants and over. In some of these towns the most prominent business men have formed an agreement to pay for the energy consumed by the lamps which light the main business street. Most of them appreciate the value of a well-lighted business section both to bring business and as a protection against robbery at night.

Since these systems as a rule require hardly more than eight or ten 100-watt lamps, a fourth wire is run from the distribution transformer on the company's poles to the position of the last desired lamp. Then these lamps are connected in parallel by another wire going directly to the neutral, as illustrated in the diagram below. By using the fourth wire to the transformer the voltage on the regular three-wire system is not seriously affected.

A control snap switch is installed where it is most readily accessible and in some localities is worked by the telephone operator. When more lamps are needed a division can be made, improving the load balance. The costs on such systems have been low since it is only necessary to add new cross-arms, wire, lamp brackets and reflectors. The maintenance expenses of the system are borne by the power company.



THIS CONSTRUCTION AFFORDS STREET-LIGHTING SERVICE TO SMALL COMMUNITIES

Neat Design of Compact Polyphase Test Table

BY J. P. GALLAGHER
Superintendent of Meters, Erie Lighting Company, Erie, Pa.

IN THE design of polyphase test tables usually a great amount of apparatus is employed, but, contrary to this practice, a table embodying compactness of design and equipped to give the essential factors and cover the field of polyphase testing has been developed by the Erie Lighting Company, as illustrated herewith. The panel is of 1-in. slate, 34 in. x 44 in. in dimensions, with ammeters in each phase and a voltmeter for 110/220 volts. The panel is supplied from a 110-volt, three-phase source through the main switch, as shown in upper right of Fig. 1, with three banks of load switches providing current adjustment from 0.25 amp. to 10.75 amp. per phase. The phase shifter used is of the wound-rotor type and has a capacity of 10.75 amp. per phase at 8.5 volts. It is mounted off the panel at lower right. The necessary current and potential binding posts and the plug switch for changing 110 volts to 220 volts are connected in each phase and controlled from the front. To the left of the load switches there are three 2-amp. continuous-duty 143-step roller-contact rheostats, permitting very close adjustment of any load desired within range of the table, with independent regulation and operation of individual phases.

The wiring as seen from the rear, with the three banks of load resistance and auto-transformers for stepping 110 volts to 220 volts, is also

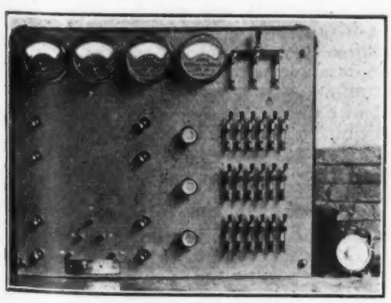


FIG. 1—POLYPHASE TEST PANEL USED BY ERIE (PA.) LIGHTING COMPANY

shown. The American Institute of Electrical Engineers recommends that for three-phase markings *A B C* and *X Y Z* be employed; and, to avoid confusion, it is better that all prints follow this plan. Since with three-phase measurement it is necessary to deal with three electromotive forces

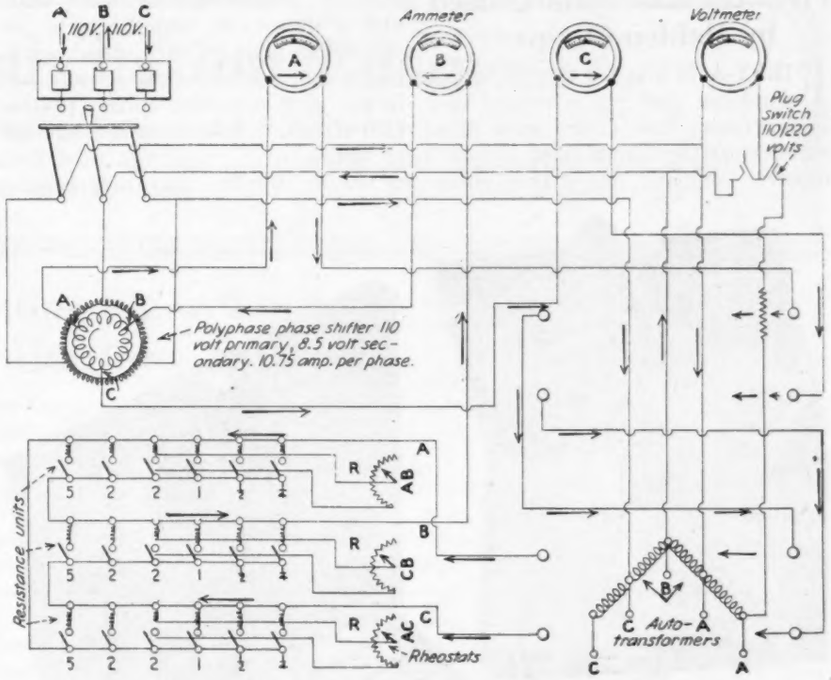


FIG. 2—WIRING AS SEEN FROM REAR OF TEST TABLE

and currents differing in phase by 120 deg., incorrect polyphase polarity markings may result in a number of complications, and for accurate results the phase relation and rotation should be carefully checked.

Extracts from an Operating Code*

Miscellaneous Apparatus in Turbine Room

ROUTINE inspection methods and regular cleaning periods for all equipment in the turbine room aid very much in obtaining high plant efficiency. The following instructions relate to the routine care and maintenance of miscellaneous apparatus in the turbine room:

1. Machines should be cleaned and wiped twice each week.
2. The racks and pinions of valve gears should be scraped and cleaned monthly.
3. Clean the screens of the oil system of turbines weekly.
4. Oil should be changed when necessary.
5. The roller transmission bearings (gimbal bearings) of the governor should be cleaned and oiled monthly.
6. Inspect the needle-valve oil supply to the governor knife edge weekly.
7. Blow out the cooling coils of the oil-cooling system every four or five months, or oftener if necessary.
8. Clean the condenser at the ends of the tubes daily, if possible.
9. Examine the overspeed device on vertical turbines before each overspeed test and repair it, if necessary. On horizontal turbines this should be done every two months.
10. Examine the worm and gear of the governor every two months and repair if necessary.
11. Examine the knife edges of the governor every four months.
12. Inspect clearance every six months and make necessary adjustments.
13. Inspect the blading of turbines yearly and make necessary repairs.
14. Clean bearings and steps yearly.
15. Examine thrust bearings yearly and repair if necessary.
16. Examine turbines and impellers on auxiliaries every six months.
17. When necessary, clean the condensers by blowing through the tubes rubber disks with nails driven through them. If the deposit is of such a nature that this method is not effective, blow "bullet" brushes through the tubes.
18. Examine the interior of condensers for corrosion every six months.
19. Clean oil system and gravity filter tanks yearly, or oftener when necessary.
20. Examine motor-operated valves every three months and make necessary adjustments and repairs.
21. Motor-operated valves should be closed at least weekly.
22. Hydraulic quick-stop valves should be operated daily.
23. All water strainers should be kept clean.
24. Close and open the main valves of the forebay inlet and outlet monthly, being sure that adjacent valves are open as each is being manipulated.
25. Clean out débris from the bottom of the well of the screening basin and overhaul the apparatus approximately every six months.

*Abstracted from the operating code of the Philadelphia Electric Company.

First-Aid Kits Standardized by Malden Company

FIRST-AID kits for the individual employee and for overhead and underground line crews have been standardized by the Malden (Mass.) Electric Company, one of the Tenney

FIRST-AID KITS FOR INDIVIDUAL EMPLOYEES AND FOR DISTRIBUTION CREWS

properties in the Boston suburban area. In the preparation of these kits economy in the use of materials was sought as well as portability and compactness. Describing the kits, Harvey K. Brown, superintendent of the Malden company, states that the importance of caring for minor accidents as well as more serious ones influenced standardization along the lines illustrated.

A kit for individual employees' use, denoted "No. 00 I. D. P.," is shown in the left of the illustration. The dimensions are 2⅜ in. x 4 in. x 1 in., the case being of 26-gage steel. Each kit contains one gauze compress about 3 in. square with attached bandage, two gauze compresses about 2 in. square with bandage attached, three ampoules of tincture of iodine, and one small collapsible tube of petrolatum. Each kit is recorded in a card index system and is inspected regularly. Kits are assigned to employees to be carried in bags or with other equipment, and the dressings, while not large, give adequate initial protection of sufferers from cuts, abrasions or burns.

The kit for line and underground crews, shown at the right and known as "No. 3 I. D. P.," is assembled in a container of 20-gage steel, 9 in. x 9 in. x 2½ in. in dimensions. The following supplies are included: twelve gauze compresses 2 in. square, eight compresses 3 in. square and two about 4 in. square, all twenty-two with bandage attached, twenty ampoules of tincture of iodine, ten ampoules of aromatic spirits of ammonia, six tubes of borated petrolatum, one compress of absorbent gauze, one bandage, one wire splint, one triangular bandage, one tourniquet of heavy webbing, one pair light steel forceps and one set for eye injuries. These kits are made by the Hygienic Fibre Company of New York City.

Rules for Unloading Poles

BY E. A. LINDSLEY
President Lindsley Brothers Company, Spokane, Wash.

WITH a view of reducing serious and in many cases fatal accidents caused through ignorance and negligence on the part of workmen engaged in the unloading of poles, this company has formulated a set of rules which are in force in its yards and are advocated for use by all companies engaged in handling poles. The rules given below are the result of twenty-five years' experience in the cedar-pole business:

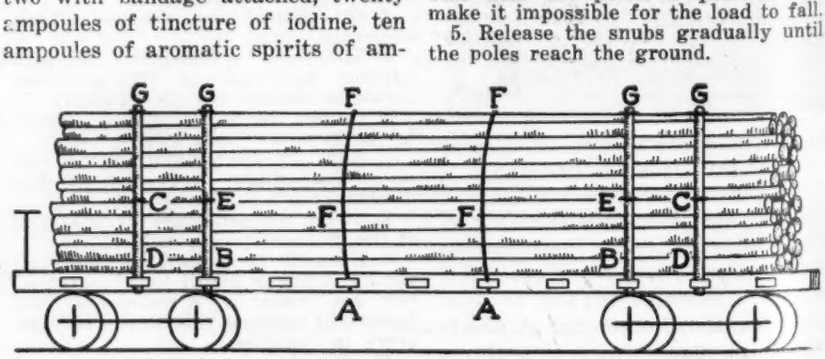
Never allow any one on top of load under any circumstances.

Never cut top wires (*G*).

Always unload car in same direction that it is leaning. If yard conditions necessitate a violation of this rule, place substantial props against the load on opposite side.

For absolute safety attach cables or ropes to pockets (*A*), throwing the cables or ropes over the car as per *F* of the illustration. The cables or ropes are then securely fastened to pockets on opposite side of the load in such a manner as to make it possible for them to be gradually released by snubbing. The following operations should then be carefully performed and followed in exact rotation:

1. Cut the two inside stakes at *B*.
2. Cut the wires at *E*.
3. Cut the outside stakes at *D* so that they are free at the pockets but both wires (*C*) are still intact.
4. Cut center wires (*C*), using a long-handled axe (an ordinary axe with a handle about 10 ft. long) so that a man standing at the end of the car will be out of danger. The stakes, having been previously cut, will swing out from the load, but the cables or ropes (*F*) will still hold the poles in position and make it impossible for the load to fall.
5. Release the snubs gradually until the poles reach the ground.



PROPER SNUBBING WHILE UNLOADING GOES FAR TO REDUCE HAZARDS IN HANDLING DISTRIBUTION POLES

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Results of Demonstrating Show-Window Lighting at Hartford

Thirty Merchants Use Model Window for One Week and Twenty-five Improve Their Own Illumination—Installation Gives Impetus to All Commercial Lighting

BY W. D. GORMAN* AND DAVIS H. TUCK†

INTEREST in window lighting has been very active throughout the country during the past two years, largely on account of experiments conducted by the engineering department of the National Lamp Works at the Cleveland store of the Oppenheim-Collins Company. It was conclusively demonstrated there that the drawing power of a show window could be greatly increased by raising the intensity of the illumination. This increased interest has resulted in the following well-defined practices:

1. Average night illumination intensities have increased from 25 ft.-candles to 100 ft.-candles for a well-lighted window in the business section of a city.

2. Tests at Milwaukee and at Cleveland indicate that intensities up to and beyond 100 ft.-candles are a paying investment for the merchant.

3. The use of spotlamps and floodlamps in windows by daylight and evening has become popular in the past year.

4. Colored lighting in show windows is becoming more popular but is yet in its infancy. So far there has been little attempt at artistic color effects like those on the stage.

5. The method of installing window-lighting equipment has become highly standardized owing to the fact that three manufacturers of window-lighting reflectors have standardized on 100-watt and 150-watt lamps and two types of light distribution for deep and shallow windows. In general 100-watt or 150-watt "Mazda" lamps in angle-type prismatic or mirrored reflectors spaced on 12-in. to 14-in. centers along the entire glass front represent the best present window-lighting practice.

6. It is believed that the use of larger lamps (200 watts to 300 watts) to obtain even higher general intensities, larger and more powerful spotlamps and the more intelligent use of colored lighting will mark the coming year.

METHODS employed to demonstrate the advantages of better window lighting are of particular interest to commercial men at this time of the year, when merchants are most receptive to suggestions for increasing the sales value of their window displays. In this article Mr. Gorman and Mr. Tuck have outlined a definite plan for obtaining this business which has proved its merit in actual practice.

About two years ago the need of better window lighting in Hartford was forcibly brought to the company's attention. Up to that time the company considered its own show windows well cared for, but after equipping them with modern display lighting it was realized that only the first step had been taken. The method of developing show-window lighting has been mainly by a store-to-store canvass, some newspaper advertising and on the backs of bills.

ATTITUDE OF MERCHANTS

Because of increased competition and more careful buying by the public merchants are willing to listen to any arguments that will increase their trade. Engineering layouts of windows and light patrol switch service have helped to induce customers to utilize long-hour burning.

On the two main streets of Hartford colored lighting is required for distinctive store illumination. The company has been carrying a stock of color screens and spotlamps which it has loaned with good results.

WINDOW A SALES LABORATORY

Realizing the value of high-intensity window lighting, the company decided several months ago to design and install a show window embodying the most up-to-date methods and to offer merchants free display space in this window for stated periods. The results of the first seven months' work with this window are most gratifying.

The window is on Ann Street, in a part of a downtown substation. This street connects two of the principal thoroughfares of the city by a short block, and the window can be seen from either street. A "jog" was cut into the substation property so that glass could be put into two sides of the window. There are 12 linear feet of glass on Ann Street and 10 linear feet on the other side. The window is 10 ft. deep, 8 ft. high to the bottom of the transom, and has a floor area of 112 sq.ft. The trim is finished in a light-gray paint having a reflection factor of 70 per cent. There are three rows of reflectors (Fig. 1), spaced on 12-in. centers along each of the two glass sides, there being a total of fifty-two reflectors.

The reflectors are Holophane No. 922 and are mounted on Appleton No. 7319 holders and Crouse-Hinds JR-2-6 type condulets with type C-2 porcelain receptacles. Clear "Mazda" lamps of 150-watt size are used with a total wattage of 7,800, or 70 watts per square foot of floor area. When all lamps are burning without color filters, an illumination intensity of 400 ft.-candles is obtained on a horizontal surface. Color filters with gelatine refills of thirty-two colors are available for color effects. The fifty-four outlets are arranged on twelve circuits so that alternate lights of the same row are on one circuit. Provision is made for three spotlamps and two wall brackets. There are also three center ceiling

*Illuminating engineer Hartford (Conn.) Electric Light Company.
†Electrical engineer Holophane Glass Company, New York.

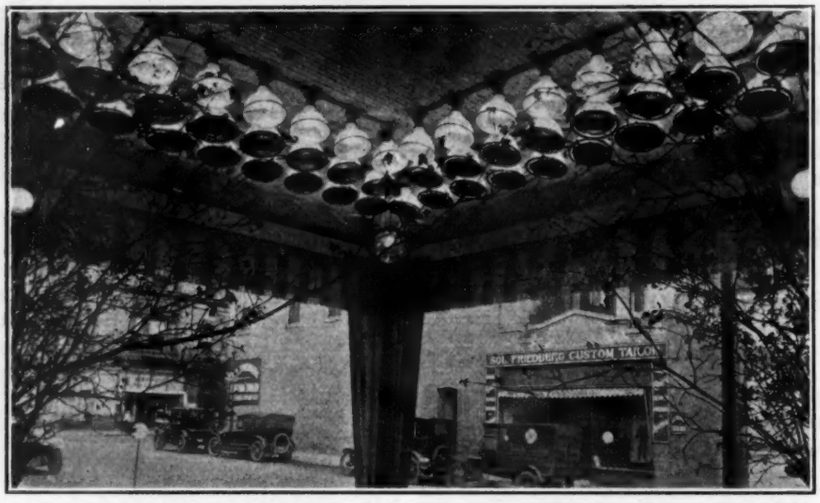


FIG. 1—THREE ROWS OF REFLECTORS WITH CIRCUIT SUBDIVISION FACILITATE DISPLAYS

outlets equipped with "elexits" so that special luminaires can be installed, such as a dining-room luminaire in displaying dining-room furniture. A Brink motor-driven sign flasher with ten circuits is installed in a metal cabinet, and it is provided that any combination of color effects or intensities can be obtained. With the flasher the contrast of a window underlighted with one well lighted can be obtained readily.

WINDOW BOOKED AHEAD FOR MANY MONTHS

In order to get the whole-hearted interest of the local merchants, they were personally interviewed and it was explained to them that their sales could be increased by modern window lighting. To prove this in a particular case, the Hartford company offered to loan its own demonstration window to them for one week without charge. The merchant trims the window with his merchandise in the best possible way (Fig. 2), and the company arranges the lighting to display it to the best advantage. The direct sales resulting from this display of one week per merchant are the best proof that modern lighting methods help the merchant increase his sales.

At the very beginning the window was booked ahead from February, 1923, to January, 1924. Each week when the window is changed a photograph of the display is taken and a reproduction of the photograph, together with an outline of the window with appropriate "copy," is inserted in the local press, thus calling attention to the display. A circular letter is also sent to all merchants who handle similar goods inviting their attention to the window.

After the display is removed the merchant is called upon with the idea of having him install window lighting in his store similar to that under which his display was shown during the previous week. The "prospect" is then turned over to an electrical contractor so that estimates of the cost of an installation can be made.

At this writing thirty merchants have used the window for one week each, and of these twenty-five have made more or less extensive improvements in their window lighting. These consist of complete new installations, additions to present installations, provision of spotlamps, keeping window lighting on in the daytime, and the use of a free turn-off service at midnight, thus increasing the hours of burning at night. Twelve other merchants installed new window lighting as a result of the circular letters sent out. The effect of the test window on the character of the window lighting in new buildings has been most gratifying, as without exception new store fronts have been lighted to conform to the best practice, i.e., 100-watt to 150-watt lamps on 12-in. to 14-in. centers.

The company has distributed a sixteen-page booklet to all the local merchants telling what has been done and inviting their co-operation. The Hartford Electric Light Company believes that the demonstration window has been an unqualified success, not only as a load builder but as a good-will builder. An accelerating interest on the part of local merchants and the public is anticipated this fall and winter and a prize contest is under consideration. Improvements in window-lighting equipment and methods will be featured by the company as they develop.

FIG. 2—TYPICAL MERCHANT'S DISPLAY OF DINING-ROOM FURNITURE

Guiding Principles in Seeking Interconnections

INTERCONNECTIONS that could be established to the benefit of every one concerned have sometimes been delayed because of a lack of appreciation of the fact that they must be considered as a mutual benefit and selfish interests should not be allowed to prevail. A member of the power survey committee of the Great Lakes Division, N. E. L. A., who has had wide experience in bringing about interconnections has adopted as a guide in initiating co-operation of this character the following principles, which other companies may find of benefit if they are followed in spirit:

Attitude of Companies.—No interconnection can be a success unless the attitude of the respective companies and their operating forces is based upon a mutual consideration of the interests of both companies in the service of the public.

Capacity.—The capacity of all interconnections should be ample to transmit

either way all of the capacity required for an emergency with an ample margin for reasonable future growth. We have seen a number of interconnections between companies which were practically useless because in time of emergency only a fraction of the emergency needs could be transmitted even though ample capacity was available in generating facilities.

Service Protection.—Any transmission system interconnected to another similar system should have sufficiently good service conditions so that the interconnection will not jeopardize the service of the other company.

Load-Dispatching Arrangements. — There must be complete co-operation between the load dispatchers of the two systems to be interconnected and an arrangement between the two companies so that the load dispatchers themselves can immediately order connections in case of emergency. Each load dispatcher should be sufficiently familiar with the adjoining system to protect service and provide ample capacity.

Maximum Load Limitations.—Where companies are interconnected and the supplying company for some reason must reduce the capacity, a notice should be given to the receiving company as far ahead as possible so that the service of the receiving company shall not be interrupted.

Rates for Service.—Most interconnections combine regular supplies for wholesale power with emergency service either way. In such cases there should be a rate for the regular service and a separate rate for the mutual interchange of energy in emergencies. In fixing the rates for interconnections the economic benefits of the interconnection should be shared between the parties, and any attempt of one company to secure for itself all of the benefits of an interconnection is sure later to defeat the purposes of the arrangement.

Diversity of Loads.—Generally speaking, there is a diversity of load between adjoining systems due to peculiarities of industries served or other conditions. The fullest co-operation should take place between interconnected systems in seeing that this diversity of load is taken care of so as to reduce the total cost of operation of both systems. This may take the form of interchange at certain seasons of the year on account of seasonal diversity, or it may be an interchange at different times of each day, owing to a difference in the load characteristics as between day and night loads of the two systems.

Construction Costs of Interconnections.—Generally speaking, the costs of interconnections should be shared equally by the parties, with the exception that the physical property up to the point of interconnection should be owned by the company in whose territory it is located. This may mean, however, an adjustment of fixed charges in some cases where the benefits of interconnection are to be mutual but where local reasons compel the location of a substation in the territory of one of the companies when it cannot be located satisfactorily at the point of connection. Maintenance of transmission lines should be done by each company up to the point of connection.

Public Relations. — Interconnections between adjoining companies aid public relations. They enable interruptions from transmission-line failures to be reduced, and the public should be aware of the fact that such interconnections are entirely in the public interest as they multiply the sources of power and use jointly the resources of several companies where one company without such interconnection would have to have invested large sums of money or spare units or duplicate transmission lines. Interconnections reduce the spares which can safely be carried in transmission systems if operated independently.

Range Survey to Be Made in Northwest

A THOROUGH investigation of every phase of the electric range situation among the member companies of the Northwest Electric Light and Power Association is to be the most important work of the Commercial Section during the coming year. The executive committee of the association at its first meeting in Seattle recently went on record as being in favor of making the survey. Last year's Commercial Section recommended that the association appropriate the necessary funds to carry on the work, but the executive committee decided that the expense should be borne by the central stations and the manufacturers. The Commercial Section was authorized to interest itself in the raising of the necessary funds in so far as the contribution to be made by the central-station companies is concerned.

A great deal of the proceedings of the Commercial Section at the annual convention of the association held in Seattle last June was devoted to a discussion of the electric range situation. The section suggested that a complete survey be made to determine whether this business is profitable to central stations under their various conditions of operation. It was pointed out that central stations were reasonably well satisfied that the range load helps the business as a whole, but it was felt that the most important consideration is to get definite figures from the experience of central stations and to determine the possibilities of a greater degree of saturation of this class of business. The investigations in the past have been largely devoted to proving the success of the electric range and its competitive advantages with other forms of fuel. The proposed survey will endeavor to ascertain the cost of service, the revenue derived and the maintenance cost of ranges. It is proposed to employ a special man on this work and to get the survey under way as early in the year as possible.

What Other Companies Are Doing

Hartwell, Ga.—A daylight kitchen campaign was carried on for six days by the Carter Electric Company of Atlanta and the Georgia Railway & Power Company with excellent results. One out of every three houses in that city was sold, thus proving that the small-town resident is as promising a "prospect" for good lighting as is the man in larger communities. A similar campaign is to be carried on by the power company in other cities throughout its territory.

Lewiston, Me. — Reconstruction of the steam auxiliary plant of the Androscoggin Electric Company, now a part of the Central Maine Power Company system, is being pushed under a fifty-two-day schedule to overcome threatened power shortages due to the long-continued drought. A 6,750-kw. unit will replace two units of 1,500-kw. combined rating installed in 1914, and the boiler plant is being enlarged and changed over to fuel oil. The work is being done according to a construction timetable. Recently a second tie line has been completed between the company's Deer Rips hydro-electric plant and the Lewiston station.

Boston, Mass.—All previous records for applications for electric service were broken on the system of the Edison Electric Illuminating Company of Boston, on Oct. 1, when 525 seekers of energy supply made known their desire to become customers. House-wiring business is extremely active in eastern Massachusetts; a large amount of new mercantile building construction is under way in Boston and vicinity, and interest in improving the electric service by increasing or remodeling old installations is growing from month to month.

Green Bay, Wis.—The Wisconsin Public Service Corporation, which is furnishing electric light and power, electric railway, street railway and gas service to the public in northeastern Wisconsin, has enlisted all of its employees in eleven counties in a campaign to dispose of 7,500 shares of its 7 per cent preferred stock, the proceeds of which will be used to finance extensions and additions to its properties. Since March 28, when the present plan was adopted, patrons and employees have purchased $720,000 worth of stock.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Water Power of the Mamasa River.—P. M. VAN BOSSE.—An extensive description is given of a project for the utilization of the water power of the Mamasa river (Celebes, Dutch East Indies) for industrial purposes. A total of 180,000 hp. will be available during ten months of the year at a head of about 1,700 ft. Power will be obtainable at the seaport Polewali at low cost, estimated at thirteen one-hundredths of a cent per kilowatt hour.—*Ingenieur (Holland)*, Sept. 1, 1923.

Super-Power Plants and Coal Conservation.—E. DOUGLAS.—A discussion of the fundamental principles of fuel conservation and the relation of heat and power requirements.—*National Engineer*, September, 1923.

Losses Affecting Water-Power Developments.—W. T. TAYLOR.—Conclusions based on comparisons of water losses over a catchment area are, in general, as reliable as those based on either rainfall or run-off, and sometimes more reliable. If a study of the run-off and water losses of a given area indicates that these losses are abnormal, then a geologic investigation should be made to find the leakage. Water leakage in a power development may be expected to occur on areas covered by deep beds of sand, gravel and porous glacial deposits, through broken, seamy and fissured rocks, etc. Among the subjects discussed by the author are an investigation of hydraulic losses, seepage, capillarity and evaporation, estimating the probable run-off, operating records and their value.—*Canadian Engineer*, Sept. 25, 1923.

Oil Engines for Reducing Power-Plant Costs.—L. H. MORRISON.—The author relates how the addition of two Diesel engines at the 1,600-kw. municipal plant, Freeport, N. Y., effected a saving of $19,000 a year, based on costs with existing steam units.—*Power*, Sept. 18, 1923.

Generation, Control, Switching and Substations

Grounding. — L. SEKUTOWICZ. — This very elaborate paper of thirty-four pages deals with investigations of grounding problems and grounding arrangements, such as are used in transmission and distribution systems for the safety of operation, to carry atmospheric discharges to ground, to connect the neutral in alternating-current or direct-current networks to ground, etc. The first part of the article contains detailed theoretical considerations and a large amount of results from actual tests and measurements of the distribution of the potential around, between and near grounding points, made on a very large scale. Using a method similar to that employed in Weather Bureau isobar charts, giving the distribution of barometric pressure over a large area, the author shows isopotential charts of the area around a power-distributing center in France. These charts were obtained from a vast number of ground potential measurements, introduced into a topographical chart of the area, the points of equal voltage being connected with irregular curves closed into themselves. A chart of this nature shows the great irregularity of the conductivity of the soil and permits the finding at a glance in a given territory of the best location for an effective ground connection. The current distribution in the ground is studied theoretically and by means of measurements, and from their results the maximum permissible current gradient is determined for safe operation. The influence of chemical admixtures in the soil and the amount of humidity are investigated. The second part of the paper describes and criticizes practical grounding methods and means of measuring the ground resistance such as are being used today in central-station practice. A complete bibliography is a valuable addition to the article. *Revue Générale de l'Electricité*, Sept. 1, 8 and 15, 1923.

Insulators and Insulating Materials.—The issue of this magazine named below is devoted specially to the present status of problems of insulation and contains eight papers covering experiences and research work on this subject. Development, manufacture and testing methods are described for natural and synthetic insulating materials, the properties of oil as a dielectric are investigated, a new method of calculating a condenser bushing is given, and a detailed description of latest types of cementless disk-type insulators is printed, with many illustrations.—*Elektrische Betrieb*, Aug. 29, 1923.

Waterwheel Generators and Synchronous Condensers for Long Transmission Lines.—M. W. SMITH.—Under the subject of generators, the following points are discussed: Leading current drawn by transmission lines and its effect upon the stability and mechanical design of generators; characteristic curves of generators designed for operation at leading power factor; special winding connections which increase the capacity of generators for leading power-factor operation during temporary periods without increasing their weight and cost; description of general construction and ventilation of a 28,000-kva. vertical waterwheel generator. The following points are discussed with reference to synchronous condensers: Operation at leading and lagging power factor and how it affects the stability, cost and weight of the machines; special winding connections and their effect on stability; general mechanical construction with particular reference to damper winding design and the use of sheet-steel end bells; the importance of losses and a curve showing values it is possible to obtain on machines with the latest improvements in design; starting kva. and how it may be minimized by the use of oil pressure in the bearings. This paper was presented at the Pacific Coast convention.—*Journal of A. I. E. E.*, September, 1923.

Transmission, Substations and Distribution

Transmission Line for Oak Grove Development of Portland Railway, Light & Power Company.—H. R. WAKEMAN and W. H. LINES.—This paper covers the design of the 110-kv. transmission line to transmit energy from the new Oak Grove development of this company to the city of Portland, Ore., a distance of 54 miles. A detailed description of the line construction is given. The paper was presented at the Pacific Coast convention.—*Journal of A. I. E. E.*, September, 1923.

Ground Return for Power Lines.—G. VIEL.—To supply small customers like farmers with electrical service the installation of a double line is frequently found to be too expensive. The author claims that it is neither dangerous nor disturbing to telephone lines to carry to the customer only one galvanized iron or copper wire and to make the return through ground. Results from actual tests made with voltages as high as 11,000 seem to corroborate the author's assumptions. Figures for electric loss and cost are given in several instances to show the great savings which can be realized by a single-wire, ground-return, single-phase transmission system as compared with customary methods. Owing to the difficulties in providing a reliable grounding with low resistance it is not recommended that an attempt be made to transmit low-voltage (110 or 220) energy over one wire and ground return. French electrical standardization rulings at present forbid the utilizing of a ground return for light or power service, but the hope is expressed, based on the investigations made, that this ruling will be repealed soon in the interest of hundreds of small consumers.—*Revue Générale de l'Electricité*, Aug. 25, 1923.

Revision of Circular on Standards for Electric Service.—Several meetings have been held recently discussing the revision of Circular No. 56 on "Standards for Electric Service." The bureau has had the benefit of criticism by members of a committee representing the

N. E. L. A. and the Association of Edison Illuminating Companies. A new edition is being published.—*Circular No. 56 of the Bureau of Standards.*

Units, Measurements and Instruments

Development of High Efficiency in Centrifugal Pumps.—A. F. SHERZER.—A description is given of a recent program of experimental design carried out in the hydraulic laboratory of the University of Michigan. Specifications of centrifugal pumps, efficiencies of pumps with low specific speed and characteristic curves for several high-head experimental pumps are discussed.—*Engineering News-Record*, Oct. 4, 1923.

Radio-Frequency Tests on Antenna Insulators.—W. W. BROWN.—After analyzing the design considerations for high-voltage radio-frequency continuous-wave antenna insulators, data are given on the heating, losses and flashover points of a number of sizes and forms of porcelain-rod insulators, both dry and wet. The effect of rain shields, electrostatic strain shields and "breathers" on the behavior of the insulators is discussed. The voltage distribution across insulators in series was determined and its effects on design are given. A study of visual corona point on conductors at radio frequencies is included.—*Proceedings of the Institute of Radio Engineers*, October, 1923.

Illumination

Incandescent Lamp Production in Russia.—A. P. IVANOFF.—In 1914 the total number of incandescent electric lamps required in Russia was estimated as 16,500,000 for homes and 500,000 for streets and public halls (100 cp. and up). Russian factories (four in number) at present cannot supply more than 4,000,000. Such conditions will endure for a considerable period of time, because the increase of production will not be sufficient to cover the increase in demand. Before the war all raw materials were obtained from Germany. At present there is a glass factory which can supply sufficiently good glass. Tungsten wire is still foreign.—*Electrichestvo (Russia)*, No. 4, 1923.

Motors and Control

Operation of Induction Motors.—H. COTTON.—The ordinary induction motor suffers certain electrical defects leading to poor power factor and low loads. The component of the stator current which produces the magnetic flux lags in quadrature behind the stator-applied voltage, so that even at full load the power factor cannot reach unity. The magnetizing current is constant and independent of the load, so that the power factor drops at partial loads. This characteristic of the ordinary induction motor has led to numerous endeavors to improve power factor by impressing an external electromotive force upon the rotor circuits. The operation of induction motors under these conditions is dealt with by the author in a two-part article commencing in the issue named below. The author also considers in detail the series commutator motor and its modifications, illustrating his points with vector and circle diagrams.—*Beama (England)*, September, 1923.

Squirrel-cage Induction Motor with High Starting Torque.—T. F. WALL.—In this motor the rotor conductors are built up as composite bars as follows: A central copper rod is surrounded by a steel sheath, and the outside of the steel sheath is copper-plated to a suitable thickness. Each rotor conductor is thus in effect a simple form of transformer, the central copper rod being the primary winding, the steel sheath being the magnetic core and the outer copper plating the secondary winding. In accordance with a well-known law in the theory of transformers, the desired result is obtained that the resistance of the rotor winding is automatically increased at starting, while when normally running it has the same value as for a standard type of squirrel-cage motor.—*Paper presented before the British Association at Liverpool, England*, Sept. 12-19, 1923.

Electrophysics, Electrochemistry and Batteries

The Effects of Weak Magnetic Fields on Polarization of Radiation.—R. W. WOOD.—The resonance radiation of mercury vapor in a vacuum, at a pressure of about 0.0001 mm., is polarized to the extent of 90 per cent. This polarization is completely destroyed by a magnetic field of 1 gauss or 2 gausses, directed toward the observer. The magnetic field of the earth reduces the percentage of polarization to less than 50. Other orientations of field produce polarization of the radiation in directions in which it is normally absent, e.g., in the direction of the electric vector of the exciting light. Sodium vapor, similarly excited by D_1D_2 radiation, exhibits less than 10 per cent of polarization in the absence of any magnetic field. This small trace of polarization is destroyed under circumstances similar to those which obtain with mercury vapor, except that a field of about 100 gausses is required. With the field oriented in other directions, the percentage of polarization is increased to 30 or more. With the exciting light (electric vector perpendicular to the plane of paper) and the magnetic field parallel and in the plane of the paper, there results strong polarization in directions perpendicular to the plane of the paper. In the absence of magnetic field no polarization would be exhibited in this direction. If the field is rotated through 90 deg., remaining in the plane of the paper, the plane of polarization turns with the field, the electric vector of the resonance radiation being horizontal when the field is vertical. If, however, the electric vector of the exciting light is in the plane of the paper (i. e., vertical) the polarization diminishes as the magnetic field is rotated, becoming zero with the field at 45 deg., and rising to a maximum again when the field is vertical. These relations are difficult to describe without the aid of a diagram, but it seems quite evident that an orientation of the molecules in the magnetic fields is being dealt with.—*Paper presented before the British Association at Liverpool, England*, Sept. 12-19, 1923.

Electrochemistry of Gases.—S. C. LIND.—The present status of electrochemical action in gases is discussed and is compared with electrolysis. The necessity for indirect methods of investigation is mentioned and the gaseous reactions taking place under ionization by radioactive agencies are cited. Some new laws regarding ionization and chemical activation are stated which are supported by recent physical evidence.—*Paper presented before the American Electrochemical Society at Dayton, Ohio*, Sept. 27-29, 1923.

Telegraphy, Telephony, Radio and Signals

Improved System of Modulation in Radio Telephony.—C. A. CULVER.—After describing the commonly employed absorption and constant-current systems of radio-telephone modulation, the author discusses a system of modulation wherein the resistance in the grid circuit of the power oscillator tubes is vocally varied, this resistance being itself the plate circuit of a suitable vacuum tube. Operating data on sets embodying this method are given.—*Proceedings of the Institute of Radio Engineers*, October, 1923.

Miscellaneous

Electric Ship Propulsion.—F. H. CLOUGH.—The author discussed the following aspects of his subject: Consideration of power and speed of screws; propelling machinery — reciprocating steam engines, steam turbines, Diesel engines; reason for adopting steam turbines; need for speed-reduction mechanism; single and double reduction gearing; tooth pressures, lubrication, increased stresses due to acceleration and faulty alignment; electric transmission of power, alternating and direct current; comparison of size and weights of electlic motors and gear wheels; description of operation of electric generators and motors, magnetic forces; revolving fields; model showing action of forces and speed-reduction features; control operation of excitation and reversing switches; analogy with motor-car control; model to show operation of control; further considerations of electric transmission—efficiency, reliability, repairs, ventilation; effect of electric transmission on turbines and propellers, super-heated steam, reversing blades; use of double-ratio transmission for naval vessels; electric transmission for Diesel-engine ships; use of most suitable speeds; examples of electric ships and experience obtained with them.—*Paper presented before the British Association at Liverpool, England*, Sept. 12-19, 1923.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Girand License Up Again

Once More Decision Is Put Off—Weeks Must Align Himself with Work or Wallace

APPARENTLY with the idea of discussing the matter with the Cabinet, the Federal Power Commission deferred until next week its decision in the matter of the Girand license. At the meeting on Oct. 22 Secretary Wallace is understood to have favored the immediate execution of the license. Secretary Work is thought to have contended that the license should be withheld indefinitely until a definite policy may have been worked out for the development of the Colorado River as a whole. Secretary Weeks evidently was not ready to cast the deciding vote which might cause ill-feeling between Cabinet members.

It is recognized by close students of the Colorado River situation that the real influence which is delaying the development of the river is the incubus of public ownership. Those who are opposing the Girand license are those who want to see Uncle Sam go into business in a large way along that stream. There can be no doubt that a majority of the Cabinet will oppose a government enterprise when private capital is willing to undertake the development. There is every reason to believe that the commission will make its decision at its next meeting. The impression is quite general that the vote will be in favor of the execution of the Girand license.

First Unit of New Waukegan Plant in Operation

The first unit of the new Waukegan generating station of the Public Service Company of Northern Illinois—a 25,000-kw. turbine—has been put in operation. The energy developed is to be distributed throughout the North Shore district from the city limits of Chicago to the Wisconsin state line over four 33,000-volt transmission lines. The high-capacity steel-tower transmission line now under construction will be completed in a few months and will serve as a main tie between the Waukegan station and the company's system at Evanston, enabling large quantities of electricity to be transmitted both south from the new Waukegan station and north from Evanston. Handicaps imposed by the demand for electricity which heretofore occurred annually at this season of the year are now removed, and an immediate improvement in operation resulted when this additional energy supply became available for use.

In its present condition the new station has about half the capacity of the Blue Island plant, which was considered at the time of its erection to be something of an experiment. It is equal to the big Joliet station, although the new turbine now being erected in the latter will double its capacity. When the Waukegan station is completed it will have a capacity of 275,000 hp.

A little more than sixteen months elapsed between the time of letting the contracts and the time when the station was placed in operation. This is a record of power station construction which the owners believe has not been equaled. Marked aid in minimizing construction time was secured by the employment of electric power from the present station at Waukegan. It was used in the operation of electric cranes and for a number of other construction purposes.

The plant is built on a tract of 80 acres adjoining Waukegan on the north. The site constitutes the last piece of lake shore property available for power station purposes between Kenosha and the Indiana state line. The entire 80 acres is required for buildings, coal storage, railroad tracks and so on. A pond on the tract provides the water supply.

State Executives Discuss Superpower

At the West Baden (Ind.) Conference Governor Pinchot Presents Economic Reasons for Its Development—National Aspects of Interconnection Presented

SINCE the development of any superpower system would by economic necessity be interstate, it should be incumbent upon the federal government to see that troubles and difficulties similar to those growing out of interstate commerce in the past are avoided in dealing with the question of "power pooling," Governor Gifford Pinchot of Pennsylvania declared in his address on "Giant Power," which was the final subject before the fifteenth annual conference of Governors, held at West Baden, Ind., on Oct. 19. Governor Pinchot did not attempt to lay down any method by which this could be accomplished. He felt that the superpower problem should not be thrown directly at the federal government before it was taken up by the individual states.

After tracing the effect of power on the evolution of civilization, Governor Pinchot separated the superpower project into two parts. The first dealt with the question of how it was possible to develop such power, either by steam or hydro-electric plants, along lines that could assure private capital a fair return. The Governor felt that the project would be entirely too large for private control and that it must not be dominated by short-sighted individuals. He conceded that it was quite as important to the public that a fair return be obtained as it was to the investors.

Governor Pinchot's second point was the conservation of the nation's resources in order to safeguard the public interests of the future, and as this involves the use of hydro-electric power, he declared that greatest economy would be obtained by the unification of steam and hydro plants into one vast system such as the Atlantic seaboard superpower project. Since only 15 per cent of the available water power is now undergoing development, further steps should be taken to push this work. The Governor said that the provisions of the federal water-power act of 1920 were hostile neither to the state nor to private interests, but were a safeguard to future generations.

Regarding his own state, Governor Pinchot declared that the federal power act had been dovetailed into the power acts of Pennsylvania, thereby offering a double safeguard for conserving the resources of the state. He told of the plans to co-ordinate mammoth steam generating plants at the mines with the water resources of the Eastern States by means of high-tension transmission lines. Since this was an economic development, Pennsylvania could well afford to forget its boundary lines because of the saving in coal. He also held that power pooling would have a tremendous effect upon the economic condition of the farmers through whose territories these "lanes of power" would pass. These economic superpower changes the Governor held to be absolutely inevitable.

Governor John J. Blaine of Wisconsin in the discussion laid stress upon the state's protection of future generations in that it could not give away

any heritage of nature. In Wisconsin the state has no ownership of stream flows but has only a trusteeship over navigation and fishing. By giving indeterminate franchises the state can, as it sees fit, recapture these franchises, thereby preserving the public rights of the future. The Governor directed attention to the unfairness of rates charged in certain Wisconsin cities on the "loop system" as contrasted with the rates for the identical energy sold, across the state boundary, in the Twin Cities.

Reasons why Maine did not allow energy to leave its borders were expressed by Governor P. P. Baxter. He explained this as being due to a policy of self-preservation. Since the state is at the extreme end of the nation, there is virtually no cross-flow of industrial trade. Much of the material manufactured within the state is shipped out. In order to prevent the state from becoming entirely impoverished, every utility franchise has a clause restricting the exportation of power. Although the state has 700,000 hp. of undeveloped energy, only 460,000 hp. is actually in use. The Governor admitted that the state's right so to limit its own production of energy has never been tested in the Supreme Court, and the future might alter its course on superpower development.

Nine Indiana Municipal Plants Turn to Central Service

Another evidence of the passing of the small-community lighting and power plant is given in the announcement by A. C. Babson, vice-president and general manager of the Central Indiana Power Company, that contracts have been closed to supply electrical energy to nine towns and cities served heretofore by municipally owned and operated plants. These places are Covington, Veedersburg, Tipton, Montezuma, Kingman, Ladoga, Paragon, Argos and Etna Green—communities that will serve as connecting links in the state-wide power system now being built up by the Brewer interests. The Central Indiana company is now serving or has entered into contracts to serve more than 114 towns and cities in the central and northern portion of the state.

In each of the new contracts entered into the community has obtained service at a lower rate than under the old system of small unit operation, Mr. Babson said. The company is constructing a high-tension line from Noblesville around the eastern and southern limits of Indianapolis to a large substation in process of construction west of the city. This line, it is expected, will be "tied in" early next year with the high-tension line from the company's new superpower plant south of Terre Haute. Branch lines will extend north from Noblesville, connecting with other high-tension lines that will serve northern Indiana.

Program of High-Tension Conference

French, Italian, Spanish, Dutch and American Engineers Will Discuss Transmission Problems at Forthcoming International Gathering at Paris

AS NOTED in our issue of Sept. 15, the second international conference on high-tension power lines will be held in Paris Nov. 17 to Dec. 1. This conference is given over almost entirely to the discussion of subjects connected with the design, construction and operation of high-voltage trunk lines, in which there is a growing interest in all parts of Europe. The general arrangements for the conference are in the hands of the Union des Syndicats de l'Electricité, of which J. Tribot-Laspière is the general secretary. The following reports have already been submitted:

COMPREHENSIVE RANGE OF PAPERS

"The Operating Protection of a Large Hydro-Electric High-Voltage System," by F. M. Gillespie, superintendent of operation of the Ebro Irrigation & Power Company, Barcelona, Spain. The author describes the different devices employed on the Ebro system and shows the results for different loads when synchronous condensers are employed. He also discusses frequency regulation, voltage regulation and power-factor correction and isolation of faults.

"Relay Protective Gear for Large High-Voltage Networks," by F. Dejong, superintendent of testing department of the Ebro Irrigation & Power Company. The paper describes relay practice and experience of the Spanish company and shows how different kinds of relays have acted in cases of failure.

"The Insulator Problem from the Operating Man's Point of View," by C. E. Bennett, assistant chief engineer of the Ebro Irrigation & Power Company. The author points out the different factors to be considered when choosing insulators and reports on the experience of his company and the methods employed for testing and replacing insulators.

"A 900-Meter Crossing on a 130-Kva. Line," by Renzo Norsa, chief engineer of the Società Elettrica Interregionale, Milan, Italy. In this paper a description is given of the Po River crossing at Plaisance. The author explains the problem and shows the different solutions which were examined. He also describes the work and presents graphs illustrating the strains on the towers.

"Modifications Proposed to the Standard Rules Actually Used for the Construction of High-Tension Power Lines," by J. G. Bellaar Spruyt, president of the Association of Managers of Electric Plants in Holland. The author shows the disadvantages of the old specifications and explains the new rules which have been proposed by the Royal Institute of Engineers at the demand of the Ministry of Public Works.

"Outdoor Substations in the United States," by H. W. Young of the Delta-Star Company and Alfred Alsaker of Chicago. The development of small outdoor power stations in the United States is described by the authors, who also give data on their establishment and incorporate short descriptions of large power substations.

"Technical Specifications of Extra-High-Tension Power Lines in France," by Paul Meyer, engineer of the Compagnie Générale d'Electricité, Paris. The necessity for new specifications is emphasized, and the author enumerates the principal rules which because of derogations must be modified.

"Development in Insulator Practice," by R. P. Jackson, manager material and progress engineering department, Westinghouse Electric & Manufacturing Company, East Pittsburgh. In this paper the author describes the different types of insulators which are actually in use.

"Transmission Voltages," by F. C. Hauker, general engineer Westinghouse Electric & Manufacturing Company. The standardization of voltages is recommended by the author, who shows the increase of transmission voltages and points out the difficulties encountered with extra-high tensions. The A. I. E. E. standard voltages are recommended as possible international standards.

"American Practice in Oil Circuit Breakers," by B. MacNeill, engineer. The development of oil circuit breakers, especially for outdoor service, is traced and methods for testing the breakers are described.

"Lectures on the Use of Electricity and its Dangers," by J. G. Bellaar Spruyt. The paper is devoted to popular educational lectures for the purpose of warning people, especially children, of the danger of electricity.

Northern States' Jim Falls and Wissota Dams

Announcement is made by the Northern States Power Company of the completion of its hydro-electric power plant and substation at Jim Falls, Wis., on which work started in June and which has cost approximately $100,000. The plant will generate 16,000 hp., to be sent through the substation erected near by to the company's Wissota plant or direct to St. Paul or Minneapolis.

The company makes also a further announcement in connection with its plan to construct a great substation at the south end of Wissota Dam to cost approximately $1,000,000. The total area to be covered by the station will be 490 ft. by 210 ft., and it will be one of the largest stations of its kind in the country. There will be no buildings, the entire space being covered by steel towers carrying a heavy network of high-tension wires to transmit energy

from the hydro-electric plants at Jim Falls and Wissota. From this new substation energy will in turn be transmitted to the thirty-seven general stations supplied by the Northern States Power Company, which will eventually be distributed among 459 cities, towns and villages in Wisconsin and Minnesota. An outside substation was erected by the Wisconsin-Minnesota Light & Power Company to supply 121 towns and cities, but with the larger number to be supplied by the Northern States Power, after the merger of the two companies, the substation naturally proved inadequate.

Good Buying Marks New York City's Electric Show

The annual Electrical and Industrial Exposition of New York, commonly known as the "Electric Show," has been unusually successful this year from the exhibitors' standpoint. In the first eight days of the meeting an attendance of 100,000 had been recorded, and it was a buying crowd beyond the experience of former years. As usual, the departmentalized exhibits of the New York Edison Company and the large display of electric trucks on the upper floor were the two most conspicuous features. Naturally appliances dominated the show.

The New York Edison Company exhibited in twenty-odd booths scattered about the hall, devoted to lighting, power, cooking, signs, transportation and other applications of electricity and also displaying New York Edison advertising and graphically portraying elements in the electrified service which is offered by this central-station company. Notable was an exhibit of underground construction, showing models of manholes, materials used, methods of splicing, etc. The United Electric Light & Power Company, the New York & Queens Electric Light & Power Company and the Yonkers Electric Light & Power Company were also conspicuous in the show.

The General Electric Company and the Westinghouse Electric & Manufacturing Company occupied prominent space. The General Electric Company gave particular emphasis to radio battery chargers, machine-shop and industrial control material. The Westinghouse company also made a feature of battery charging and switchboard equipment. Both these companies, of course, made a very complete showing of household appliances. The Singer Sewing Machine Company occupied large space in an exhibit of electric sewing machines, to which a large share of this company's publicity is now being directed. The electric truck exhibit presented a large number of models and a very interesting diversity of truck equipment.

A canvass of the show brought forth a general record of good sales made and good contacts established. One booth reported orders for 900 toasters within a period of two days. A number of new model washing machines were on exhibition, and an interesting innovation was a display of Fulper pottery and porcelain novelties in the form of electric perfume lamps. The decorations of the show this year were extremely effective. The exhibits embraced a very large and striking variety of popular applications which have developed a great deal of public interest.

Engineers of West Virginia and Kentucky Meet

Great interest was aroused at the third annual convention of the West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers, held at Huntington, W. Va., on Oct. 19 and 20, by an informal discussion on the relative advantages of motor-generator sets and rotary converters for mine service. Mining, consulting and power-company engineers as well as representatives of prominent manufacturers canvassed the subject from many standpoints. Other discussions took place on papers presented, which included one on hoisting equipment by M. A. Maxwell, one on equipment records by J. H. Edwards and one on the manufacturer's service in supplying repair parts by F. M. Reigher.

The meeting this year was the largest so far held by the association, many new members having been attracted to the society by the important work it has accomplished within the short time it has been in existence. Officers were elected as follows: President, R. R. Webster, Elkhorn Piney Coal Mining Company, Weeksbury, Ky.; vice-president, F. M. Reigher, electrical engineer American Coal Company, Bluefield, W. Va.; secretary-treasurer, Herbert Smith, Huntington, W. Va. (re-elected).

Charleston (W. Va.) Electrical Men for Co-operation

Co-operation was the keynote of brief addresses made by representatives of electrical companies in Charleston, W. Va., and other cities in that state where they met last week at a dinner of the Electrical League of Charleston. Nearly one hundred men were present.

Bliss McCrum, secretary of the West Virginia Utilities Association, declared that West Virginia was leading all the states in its rate of increase in the production of electricity and that within ten years the state should become one of the wonders of the East in that regard. This was due, he said, to the abundance of cheap coal. The state had hardly begun to harness its water power.

Charles S. Dawson, the new manager of the West Virginia Water & Electric Company, told how the central station and the contractors could work together. Fire protection, insurance, inspection and standardization of equipment were other topics discussed. Similar meetings, including lectures, are to be held throughout the fall and winter.

For the Ferris Amendment

Prominent Engineers Regard It as an Essential Step in Developing New York's Power

SEVERAL prominent engineers have expressed views in favor of the much-debated Ferris amendment to the New York State Constitution, which would permit the erection of power houses and transmission lines in the state's Forest Reserve under the restrictions already set forth in these columns.

Gen. George W. Goethals states the terms of the amendment and, while not explicitly declaring for it, says: "The federal government has a settled policy for encouraging development of our water resources whereby streams are daily turning out energy which is running thousands of our industries. In the West, particularly, splendid progress has been made in hydro-electric development. I feel very strongly that we should take advantage of our natural gifts here in New York State. Wherever possible in the public interest streams should be utilized for the creation of energy and should not be permitted to continue undeveloped. While I do not look with favor on government ownership, if it be decided that the state itself should undertake the development, well and good; otherwise it should be done by private enterprise under safeguards and limitations which will protect the people."

William Barclay Parsons says: "If New York is to maintain its standing as a great manufacturing state, if the comfort and welfare of its inhabitants are to be preserved, every available unit of hydro power must be developed within the next few years. In a material way it is the greatest problem facing the people of the state. Its seriousness is recognized only by those who are called upon to find a means of meeting the public demand. The Ferris amendment is a step in this direction. To defeat it will mean a serious blow to public welfare."

COOPER BLAMES ESTATE OWNERS

Col. Hugh L. Cooper blames the opposition to the amendment on the owners of private estates, saying: "The whole situation resolves itself into just one question, namely: For the want of about 2,000 acres of leased land, under full state control, are the industries of the State of New York to continue to be taxed $20,000,000 a year by way of unnecessary coal bills in order that the millionaire owners of 400,000 acres of Adirondack lands will not have occasionally to look at a few minor transmission lines and a few well designed hydro-electric power stations?"

W. S. Murray, who prophesies that eventually the electric light and power companies will go out of the business of producing power and will instead receive wholesale electrical energy from great power companies which will be entirely outside of their corporate existence, thus leaving as the function of the electric utilities only the distribu-

tion of the energy so received to the customers within their franchise territory, asserts: "Development of water power in the Adirondacks is one of New York State's most important contributions to the superpower recommendations for the territory between Boston and Washington, and will bring the city of New York and other larger communities within transmission radius of this region. . . . The basic question really is this: Shall the water power of the state be allowed to run to waste or shall it be harnessed for the needs of all the people of the state? Ratification of the amendment simply paves the way for definite action. Its approval by the voters then allows the state to decide on the method of development. The Hudson, Raquette and Black River drainage areas are the primary sources of hydro-electric supply from this region. My investigation of the power possibilities here indicates that 2,710,000,000 kw.-hr. can be annually produced."

CONTRADICTS COLONEL COOPER

In making public a telegram from State Engineer La Du denying that the State Water Control Commission favors the Ferris amendment, L. B. Judson of Saranac Lake, a leader in the fight against the amendment, took occasion to deny Colonel Cooper's assertions. He said: "Colonel Cooper and every power man in the state know that under this proposed amendment the state forfeits its franchise rights in the new water power to be created, valued at millions of dollars. The amendment is so riddled with jokers that even the 'rights' of the state are stricken out entirely, leaving to the state not one penny of compensation for the increased value of water-power rights. There is absolutely no safeguard left to insure compensation to the state for the water power to be created, nor is there any safeguard or provision that this power will result in giving the public lower rates. The corporate interests under Amendment 3 get everything they have been seeking for thirty years."

Hoover Honorary President of Sesqui-Centennial Congress

Secretary of Commerce Hoover has accepted the honorary presidency of the engineering congress to be held in Philadelphia in 1926 in connection with the Sesqui-Centennial Exposition in celebration of the one hundred and fiftieth anniversary of the independence of the United States. Congress has indorsed the undertaking, the city has pledged $5,000,000 or more, and a similar amount is hoped for from the state, though not yet pledged. One million dollars in private subscriptions has already been raised toward a fund of five or ten millions. The total cost of buildings and grounds will reach $15,000,000. Fairmount Park and the neighboring region have been chosen as the site for the exposition, which will be open from April 30 to Nov. 11.

Mapping a Great Electrical Network

Pennsylvania-New Jersey Power System Prepares Chart for Public Use Showing Interconnections, Generating Stations and Proposed New Lines

DISTRIBUTION lines and electric power generating stations of what is known as the Pennsylvania-New Jersey Power System of the General Gas & Electric Corporation, of which W. S. Barstow & Company, New York, are managers, are shown in a clear manner on the large map of the system prepared for display purposes and here reproduced. A glance is sufficient to show the wide extent of the territory covered by the system, and closer examination reveals the type of power stations now in operation or under construction.

The power companies composing this system are the Metropolitan Edison Company of Reading, Pa.; the York Haven Water & Power Company of York Haven, Pa.; the Pennsylvania Edison Company of Easton, Pa.; the New Jersey Power & Light Company of Dover, N. J., and the Hanover Power Company of Hanover, Pa. The high-tension transmission lines that link together the distribution systems of these companies extend from Hanover and Gettysburg, Pa., through York, York Haven, Middletown, Reading and Easton, Pa., to Dover, N. J., and beyond that point to within 30 miles of New York City. The system is so situated that it will eventually form a part of the Boston-Washington superpower project surveyed for the United States government.

The map was prepared by the Metropolitan Edison Company of Reading, Pa., and was first exhibited at the annual county fair held at Reading, where thousands of people viewed it. Sharply contrasting colors were used. On a white field the boundary lines, names of cities and towns and other companies' lines appeared in black. The present and proposed lines of the interconnected system were shown by heavy red lines, and around photographs of the power stations were green borders with a green arrow indicating the site of each station.

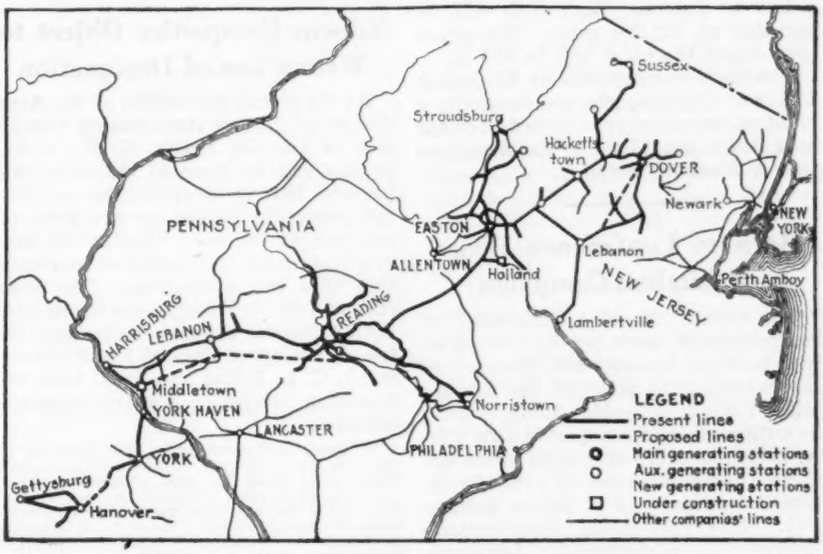


CHART OF PENNSYLVANIA-NEW JERSEY POWER SYSTEM

THE MIDDLETOWN STATION

Construction of most modern and approved type is represented in the new base-load generating station of the system now being erected at Middletown, Pa., on the Susquehanna River, about 14 miles below Harrisburg, by the Metropolitan Edison Company. Construction work started last April and has been pushed rapidly since that time. The new station will have an ultimate capacity of 180,000 kva. and will cost approximately $20,000,000. The first unit, on which work is well advanced, will represent an outlay of about $4,000,000 and is expected to be ready for operation late in the summer of 1924. It will have a rating of 30,000 kva., which is equivalent to more than 40,000 hp.

The first unit of the new station is 105 ft. by 196 ft. in dimensions. The foundations are concrete, carefully designed to withstand the upward pressure of water. More than 250 tons of steel reinforcing rods have already been placed in the foundations. The building will be of brick construction with pre-cast stone trimmings. For the first unit there will be two cement stacks, each 14 ft. in diameter and 200 ft. high. Five boilers with a capacity of 1,500 hp. will be required. They will be fired with pulverized coal, much of which will be dredged from the Susquehanna River.

Construction on a plant of equal capacity with the Middletown station has been started at Holland, on the

Delaware River, about 8 miles below Easton, Pa. The Middletown and Holland base-load stations are designed to carry the greater portion of the load requirements of the entire Pennsylvania-New Jersey Power System and are to be in constant operation at full capacity.

Plan to Store Coal for Philo Station in Abandoned Canal

An unusual feature of the power station being built by the Ohio Power Company at Philo, on the Muskingum River, near Zanesville, Ohio, is the method of coal storage. The bed of an abandoned canal is to be utilized for the bins. These will contain 300,000 tons, and to prevent spontaneous combustion of the coal they will be kept flooded. The power house, which is to have an ultimate rating of 300,000 hp., will be completed late next summer. It will be tied in with the western distribution system of the American Gas & Electric Company, of which the Ohio Power Company is a subsidiary, by a line to Crooksville, now nearly completed, and with the eastern system by a line to Canton. Both lines will be operated at 132,000 volts. The steam pressure of the plant will be 650 lb.

The plant was designed by Sargent & Lundy of Chicago, who are designing a plant of the same capacity to be erected near South Bend, Ind., by the American Gas & Electric Company.

Meriden Conference Hears of Kitchen Campaign

The annual "Meriden conference" of central-station merchandise managers was held on Monday and Tuesday of this week at the plant of the Edward Miller Company, Meriden, Conn. This is an outgrowth of a meeting of four utility sales managers held eight years ago to pool their purchases in order to derive the advantages of larger production. This year about sixty central-station men participated. Announcement was made that production on these joint purchases has now reached a total of close to 50,000, with nearly 500 companies buying. This affects portable lamp models principally.

R. D. Cutler, sales manager Hartford Electric Light Company, told the story of a kitchen-light campaign now in progress in that city. The company embarked on a thirty-day campaign in which it had been hoped to sell 5,000 "daylight units" for kitchens, and in less than three weeks 7,800 of these units, carrying 150-watt or 100-watt type C lamps, have been sold. Seven per cent of these orders have come in by telephone, 10 per cent by mail, less than 1 per cent through electrical contractors, and about 78 per cent through house-to-house selling by canvassers of the John A. Corcoran organization. The Hartford company figures on about 1,000 hours' actual use per kitchen, which, with a 5½-cent rate, will increase the annual income from these consumers by approximately $55,000 a year if 10,000 of the units are sold, which looks like a moderate estimate.

The sales managers were in conference for two days, discussing 1924 campaign methods on lamps and fixtures. The session closed with a banquet at the Highland Country Club tendered by Rex Cole, M. Schwarz, G. P. Norton and other officials of the Edward Miller Company.

S. E. D. Opens Pacific Coast Office in San Francisco

To render a more personal, intimate service to the electrical industry on the Pacific Coast the directors of the Society for Electrical Development have authorized the establishment of an office at 527 Rialto Building, San Francisco. Samuel H. Taylor, formerly president of the Electric Railway & Manufacturers' Supply Company of San Francisco, has been appointed Pacific Coast manager. Mr. Taylor will continue to serve as secretary of the Pacific Coast Electrical Association.

Edison Companies Object to Wrong Use of Designation

At the recent convention of the Association of Edison Illuminating Companies at Dixville Notch, N. H., it was pointed out by some of the executives present that several electric utilities not rendering Edison service were incorporating the word "Edison" in their corporate names. Complaint was made that this was misleading. The association felt so strongly on the matter that, following the report of a committee consisting of Samuel Insull (chairman), C. L. Edgar and J. W. Lieb, the following resolution was unanimously adopted:

Whereas it has come to the attention of the Association of Edison Illuminating Companies that in the incorporation of various companies throughout the United States for the creation, merger or combination of public utilities there is a growing tendency to make use, without apparent authority, of the name "Edison"; and

Whereas it is evident that the chief purpose of such use of the name "Edison" is to mislead by taking advantage of the significance which the name has acquired, in the first place from the illustrious achievements of Mr. Edison himself, which have made the name a household word in this country, and in the second place from the position enjoyed by the member companies of this association, which, striving from the first for the very highest standards in the electric light and power industry, have won the public's confidence and good will as reflected in the high place their securities hold in the esteem of the investing public; and

Whereas such unauthorized use of the name "Edison" is unfair both to the members of this association, which have contributed so much to maintaining the significance of that name, and to the investing public;

Now, therefore, be it resolved, that the officers and the executive committee of this association be, and they are hereby, directed to take such steps as may be practicable to stop further unauthorized use of the name "Edison," and that the member companies of this association in localities where such unauthorized use may occur be, and they are hereby, urged to do whatever may be in their power to aid and make effective the efforts of the officers and the executive committee with respect to carrying out the purpose and intent of this resolution.

Moore School Established

Independent Institution, Under the Control of U. of P., Devoted to Electrical Engineering

A CHANGE of much significance in the courses in electrical engineering at the University of Pennsylvania, Philadelphia, has taken place whereby in the future these courses will be given in an independent school, under the management of the university, instead of as part of the curriculum of the Towne Scientific School. The new school, as already announced in these columns, has been established under the provisions of the will of the late Alfred Fitler Moore of Philadelphia, who bequeathed his estate for the purpose of founding a school of electrical engineering as a memorial to his parents. Mr. Moore was the owner of the Alfred F. Moore wire-manufacturing plant and had developed the electrical end of that business. He was a director of the Bank of Northern Liberties and president of the Northern Liberties Gas Company.

By the terms of the agreement between the trustees under the will of Mr. Moore and the trustees of the university the entire estate, amounting to upward of $1,500,000, becomes in effect an endowment for this new school. For the present no new building will be necessary. The laboratories in the Engineering Building formerly occupied by the electrical engineering department, together with certain additional space in this building, will be sufficient.

ENDOWMENT WILL YIELD $70,000

The income from the endowment will be used primarily to develop undergraduate instruction in electrical engineering. A portion of it will be used for graduate instruction and to encourage research work on the part of both faculty and students. With the exception of approximately $50,000, which will be transferred to the university as payment for the present equipment of the electrical engineering laboratories, no expenditures will be made from the capital account. The endowment of the new school will therefore yield annually approximately $70,000. This, together with tuition fees, will be available to meet the operating expenses of the school. Dr. Harold Pender has been appointed dean, and Nicholas Minorsky and John B. Clothier, Jr., have been added to the staff.

In addition to the regular staff of instructors, the Moore School plans to have experts, regularly employed in the industry, give special courses of lectures during each term of the school year. For the first term of this year William Arthur Del Mar, chief engineer of the Habirshaw Electric Cable Company of New York, has been appointed special lecturer on wires and cables, and Dr. Albert W. Hull, research physicist of the General Electric Company at Schenectady, N. Y., has been appointed special lecturer on vacuum tubes and their applications.

Southern Power Firm

President Duke Reiterates the Demand for Higher Rates—If Granted, Will Spend $10,000,000

PRESIDENT J. B. DUKE of the Southern Power Company, who has recently returned from a trip abroad, has given out a statement on the policy of the company supporting strongly that made by Vice-president W. S. Lee and already reported in the ELECTRICAL WORLD. Mr. Duke says:

"I am ready to proceed to spend more money, to build more plants, to create more power for the further development of the Carolinas, but I am not willing to spend it on the basis of the returns which the Southern Power Company is now allowed. The company has averaged a return of not more than 4 per cent since it was started, and these small earnings have always been put right back into the company, and millions more. I have put approximately $6,000,000 of my own money into the Southern Power Company so far. I have never taken a cent out of it and never expect to. What I am to put into it in the future depends upon the attitude of the people toward this project as revealed through their representatives at Raleigh, the members of the Corporation Commission.

"We will lay the situation before the Corporation Commission. We will not go to Raleigh in person or engage in controversy with that body or any other about a rate increase. We will let the records speak for themselves. If the Corporation Commission allows an increase in the rate of wholesale power to 1.40 cents per kilowatt-hour, as against the 1.25 cents per kilowatt-hour now allowed us, I am prepared to build another plant that will cost $10,000,000, to supply the present demand for more electric power. Otherwise I am through."

Southern Power Service Is Curtailed by Drought

Curtailment of the use of electric power by industries in the Carolinas to the equivalent of a weekly shutdown of one day was requested by Charles I. Burkholder, vice-president of the Southern Power Company, in a letter to its customers made public Oct. 18. The basis for the request was the low water, caused by drought, in the streams from which power is developed. The curtailment, which began on Monday of this week, affected most of the textile industries in the two states.

Street lighting in Martinsville, Va., which has a municipal plant, was discontinued on several nights because of the low level in the Smith River, the power source of the town. An appeal made by the Martinsville textile company brought a supply of power from Charlotte, N. C., over the lines of the Southern Power Company, which also served to illuminate the Henry County (Va.) fair.

Southern California Edison Rates Reduced

A reduction in rates affecting all classes of consumers of the Southern California Edison Company has been ordered by the California Railroad Commission, effective Nov. 1, 1923. The reduction applies to all rates as follows: Domestic lighting, 18 per cent; street lighting, 11 per cent; industrial power, 10 per cent; agricultural rates for southern California, 10 per cent; agricultural rates for the San Joaquin Valley, 7½ per cent; railway power rates, 6½ per cent; power rates for resale, 7½ per cent.

The rate base fixed by the commission was $103,237,631, which was $8,600,000 less than claimed by the company. These sweeping reductions in rates are the fourth since the peak of high prices during and immediately following the war. The present reductions are attributed by the commission in a large measure to the reduction in the price of fuel oil, the rapid growth of the lighting business and concentration of business due to the development of the territory served by the company.

Agricultural Engineers to Discuss Electrification

One entire day—Friday, Nov. 9—will be devoted to the discussion of the rural electrification problem at the annual convention at the Great Northern Hotel in Chicago of the American Society of Agricultural Engineers.

The morning session will be given over to the reports of the rural power lines committee. Chairman C. A. Atherton, National Lamp Works, Cleveland, will open the program with a general statement relative to rural electrification. G. C. Neff, vice-president of the operating subsidiary companies of the Northwest Utilities Company, will follow with an address on the "History and Attitude of the Central Stations." A report on "Present Status of Electrical Machinery for Rural Purposes" will be given by C. M. Johnson, Westinghouse Electric & Manufacturing Company. E. A. Stuart of the University of Minnesota will talk on "Various Contract Forms," and an address on "Isolated Electric Plants" by W. H. Roberts, Electrical Auto-Lite Corporation of Toledo, will close the morning program. In the afternoon W. H. S. Stackhouse of Davenport, Iowa, will make an address, and J. W. Cloverdale, secretary of the American Farm Bureau Federation, will speak on the organization and work of the committee on relation of electricity to agriculture. An address on "The Relation of the Central-Station Service to Rural Electrification," by M. H. Aylesworth, executive manager National Electric Light Association, will follow. F. C. Fenton of the Iowa State College at Ames will close the program with a talk on "Electric Power from the Wind."

Labor Turnover and Wage Rates in Bituminous Mines

Three more voluminous reports have been added to the number made to the President and Congress by the United State Coal Commission. Two of these concern respectively "Labor Turnover in the Bituminous-Coal Industry" and "Wage Rates in the Bituminous-Coal Industry."

The study of labor turnover covers the year 1921 and shows extremes in individual mines ranging from 7 per cent to 450 per cent. For the country as a whole the degree of turnover for the industry does not appear to be greater than that which is accepted as the common experience of industries generally. The results for the 691 mines studied are as follows: Total average on rolls, 122,048; all separations from rolls, 121,840; turnover percentage, 99.9.

Two outstanding factors, the commission says, have exerted a profound influence on the character of the wage structure. The overdevelopment of the bituminous-coal industry has been the most important factor. During the

Alabama Power Company's 100,000-Ton Fuel-Storage Pile

FIGURES of the Geological Survey to the effect that most power companies have on hand a coal supply that will last only ten or eleven days have no application to the outdoor storage of the Alabama Power Company at its steam plant on the Warrior River. The illustration represents an accumulation of 100,000 tons as on Sept. 8 last.

past twenty years the annual working time in the industry as a whole has averaged more than 200 days. With the exception of the years 1917 and 1918, which reflected the stimulus of war conditions, the number of days lost annually has not been less than seventy-two, and in periods of market inactivity the number of idle days has frequently risen to more than 100, reaching a maximum of 150 days of lost operation in 1921. High tonnage rates for piece workers and high day rates for men paid by the day have thus been necessitated in an effort to secure an adequate annual wage during the days of the year on which employment is available. The wide difference in physical conditions of operation and of availability of markets has, however, entered into the fixing of wage rates and has been a second strong factor in fixing a differential in wages in different districts of the unionized fields. It has been a marked tendency of collective bargaining in some industries to bring about standard rates for organized occupations over large territories.

Still another commission report, one dealing with the wholesale and retail coal trade, was released last Monday. In this report the high margins taken by wholesale dealers came in for criticism. "The power to regulate," the commission says, "should include the power to limit to a definite maximum amount per ton the margins that may be taken by one or more wholesalers between the mine and the retailer or consumer, thus limiting speculative wholesaling. The maximum amount of margin should be the same whether taken by one or by two or more wholesalers."

Meetings and Chairmen of the A. M. E. S.

Section meetings of the Associated Manufacturers of Electrical Supplies will be held in New York on Nov. 7, 8 and 9, and there will besides be a general meeting of the association in the Engineering Societies Building at 2 p.m. and a meeting of the board of governors at 7 p.m. on Thursday, Nov. 8. In addition to the list of chairmen of sections published in the ELECTRICAL WORLD for Oct. 6, page 728, the election of the following, completing the number, has been announced:

Air Circuit Breaker Section—C. T. Evans, Cutler-Hammer Manufacturing Company, Milwaukee.

Attachment Plug Section—H. J. Morey, Pass & Seymour, Inc., Solvay, N. Y.

Fuse Section—A. W. Fox, Johns-Pratt Company, Hartford, Conn.

Industrial Lighting Section—W. D. Steele, Benjamin Electric Manufacturing Company, Chicago.

Knife and Inclosed Switch Section—J. H. Trumbull, Trumbull Electric Manufacturing Company, Plainville, Conn.

Line Material Section—W. G. Carey, General Electric Company, Schenectady, N. Y.

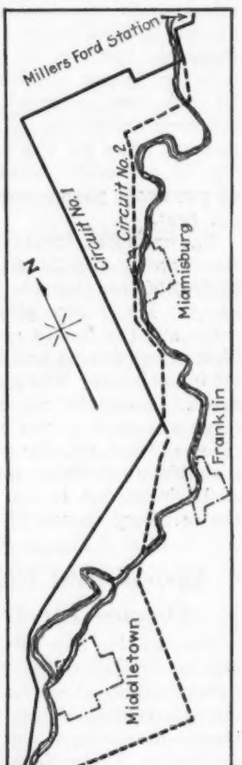
Panelboard and Switchboard Section—A. C. Streamer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Rigid Conduit Section—C. E. Corrigan, National Metal Molding Company, Pittsburgh.

Signaling Apparatus Section—Ray H. Manson, Stromberg-Carlson Telephone Manufacturing Company, Rochester N. Y.

Dayton-Cincinnati Interconnection About Completed

In order to assist the Union Gas & Electric Company of Cincinnati in carrying an anticipated peak load over the winter, the Dayton Power & Light Company has nearly finished two 66-kv. lines from its Millers Ford station to Trenton, Ohio, whence the Cincinnati company will continue the line to its own Elmwood substation. Next summer the Cincinnati company expects to build from this substation to its West End generating station. The first two miles from the Millers Ford station south will have a double-circuit steel-tower line. At the end of this two-mile stretch the two lines branch out and continue on two separate single-circuit pole lines on different rights-of-way, as in the accompanying sketch. The first circuit goes due west to the Union Road, then south on the Union Road to the Baltimore & Ohio Railroad, following it into Trenton. The second or east circuit goes south along the river road to a point opposite Moraine City; then it crosses the Miami River and follows the west side of the Baltimore & Ohio to the Union Road, where it crosses to the south side of the "Big Four" Railroad. It follows a section line down the east side of Middletown and then turns west on a line parallel to and one-half mile north of Georgetown into Trenton.



This line is composed of 50-ft. butt-treated Western red-cedar poles spaced 300 ft. apart. Five units of Ohio Brass insulators are hung in suspension and six units in strain on wooden cross-arms, while six units in suspension and seven in strain are placed on the steel poles. Aluminum steel-reinforced cables of 477,000 circ.mil capacity are employed, which will carry a 4,500-lb. tension with a half-inch coating of ice and wind pressure of 8 lb. at zero temperature.

The first line, it is expected, will be completed and in operation by Nov. 1 and the second soon afterward. These lines will also serve the Ohio Gas & Electric Company and the Hamilton Service Company.

Brief News Notes

Long "White Way" Planned for Texas.—The cities of Dallas and Fort Worth, Tex., and the intervening towns of Grand Prairie, Arlington and Handley are working out details for making an electrically lighted "white way" out of the Dallas-Fort Worth pike, a concrete motor highway connecting the two cities, on which there is still a portion unlighted. If plans for lighting this highway are successful, it is said that the stretch of 32 miles will be the longest "white way" in the South.

Northern Indiana Power Seeks to Acquire Huntington (Ind.) Properties.—Petition for approval of the purchase by the Northern Indiana Power Company, a Brewer utility, of the Huntington Light & Fuel Company, the Bippus Utilities Company and the Wilkinson Ice & Coal Company has been filed with the Indiana Public Service Commission. The properties serve Huntington and surrounding towns and cities, and it is proposed to serve them from the superpower plant of the Indiana Electric Corporation near Terre Haute. Value of the properties is given as not less than $2,040,000.

Nebraska Company Expands.—The Nebraska Gas & Electric Company of Omaha and Norfolk, Neb., which has in operation a high-tension line between those two cities, furnishing retail and wholesale electric power to all towns en route, is about to build a line to Pierce. Present indications point to the carrying out of the plans projected by the Continental Gas & Electric Corporation, of which the Nebraska Gas & Electric Company is a subsidiary, for a large water-power plant at Genoa, on the Loup River, to furnish power to all parts of Nebraska. Lincoln will eventually be served from the line leading to Norfolk and connecting with the line that comes up from Fullerton.

Hollinger Gold Mines to Build Power Plant.—It is reported by the American Vice-Consul that the Hollinger Consolidated Gold Mines, Ltd., has placed a contract for a power house and dam at Island Portage, on the Abitibi River, in northern Ontario, with Sir William Arrol, Ltd., of St. Catharines, Ontario, and London, England. It is planned to develop 25,000 hp. at the above point and deliver power to the mine within a year. It is also said that this company contemplates the installation of Diesel engines capable of developing 1,200 hp. to serve as an auxiliary source of power at the mill. The steam plant in use at present is reported to develop power at a cost of $200 per horsepower, while with the use of polar-Diesel engines the cost would be reduced to $43 per horsepower.

Memphis Has New "White Way."—Memphis, Tenn., has just inaugurated a new "white way" on Union Avenue for a distance of about ten blocks. The concrete standards are 180 ft. apart and the lamps are 22½ ft. above the street level. Memphis had previously brilliant "white way" systems on Main Street and Madison Street, and several others are projected.

Reduction in Rates in Twenty-four Missouri Towns.—The West Missouri Power Company, operating in twenty-four Missouri towns, has announced a reduction of 1 cent per kilowatt-hour in its rates, to be effective from Nov. 10. It is estimated that this reduction in rates, which was announced after a conference with the Public Service Commission, will reduce the company's revenue about $30,000 a year.

Enid Substation Nearing Completion.—The new 2,600-kw. remote-control substation of the Oklahoma Gas & Electric Company at Enid, Okla., is rapidly nearing completion. Three 63,000-volt and three 13,000-volt transformers will be installed in this station to serve the fifteen cities and towns surrounding Enid. The remote-control apparatus will be operated by motors controlled from the push-buttons at the power house. Two sets of 63,000-volt circuit breakers, one connected with the transmission lines to the east and one with those to the south, are included in the station equipment. The plant is expected to be in operation within thirty days. Within a short time Enid will also be connected to the new line under construction to Drumright by way of Covington. When this work is completed the Enid system will be hooked up with the larger cities in Oklahoma as far east as Fort Smith.

Second Power Exposition Announced.—The entire first floor of the Grand Central Palace, New York City, has already been engaged by exhibitors for the second National Exposition of Power and Mechanical Engineering, which will be open in the week beginning Dec. 3, and the space for the exhibition has therefore been extended to include the mezzanine floor. More than 90 per cent of those exhibiting at the 1922 show have re-engaged space for 1923, and many of them are using larger areas. More than 200 firms have signed contracts, and the diversity of their products insures a well-balanced exhibition that will not fail to interest all subdivisions of the engineering profession. The conduct of the exposition is supervised by an advisory committee headed by Irving E. Moultrop of the Edison Electric Illuminating Company of Boston. Among his colleagues are Frank W. Smith, former president of the National Electric Light Association; C. F. Hirschfeld, chief of research department, Detroit Edison Company; N. A. Carle, vice-president of the Public Service Production Company; E. B. Katte, chief engineer of electric traction, New York Central Railroad; W. L. Abbott, chief operating engineer Commonwealth Edison Company; Fred R. Low, editor *Power;* John L. Harrington and Calvin W. Rice.

Wapsie Power Company Sold.—The Iowa Railway & Light Company of Cedar Rapids, Iowa, has purchased the controlling interest in the Wapsie Power & Light Company, which supplies heat and power to the towns of Tipton, Lisbon, Mount Vernon, Mechanicsville, Clarence, Springdale, West Branch, Stanwood, Cedarbluff and Wald, with headquarters at Mount Vernon. The purchase price is said to have been about $300,000. The Iowa Falls Electric Company, a subsidiary of the Iowa Railway & Light Company, has purchased the Emmet Power Company at Emmetsburg, Iowa, which supplies light and power to six of the surrounding towns. The purchase price was $80,000.

Caught in the Act.—One of the unusual causes of outage which are hard to find is shown in this picture of an oil switch pedestal—one of those by which service to certain blocks is split from the main feeders of the Nebraska Power Company at Omaha. The short-circuiting rat evidently entered the

underground system from a basement and worked his way up through the conduit into the switch pedestal, then completing the ground by placing his forepaws on one of the connections of the switch.

Keeping Step with Aid of Electricity.—A new use for electric light was found recently in Columbus, Ohio, when the marshal of a large parade used it in an endeavor to maintain perfect step. For a distance of seven blocks along the right side and above the thoroughfare on which the paraders marched lamps were strung at intervals of fifty yards, each equipped with a reflector which directed the rays to the faces of the marchers. The incandescent lamps were on a special line connected with an electric sign mechanism at a point opposite the reviewing stands. This clockwork was regulated to sixty beats per minute, or half of the regulation step of the marchers. The plan was to flash the light at every step of the left foot. Complete success was not achieved, but this is attributed to the fact that only part of the marchers were aware of the arrangement, which had been put into effect on short notice.

The Westinghouse Scholarships.—It is announced by the educational department of the Westinghouse Electric & Manufacturing Company that the schools at which Westinghouse War Memorial men have been trained or are now in training include Carnegie Institute of Technology, six men; University of Pittsburgh, three men, and one each at the University of Cincinnati, Leland Stanford University, University of Pennsylvania, Pennsylvania State College, Cornell University, University of North Carolina, California Institute of Technology, Haverford College and the Ohio State University. Four scholarships, each carrying an annual payment of $500 per year, are awarded annually by the Westinghouse Electric & Manufacturing Company to employees and sons of employees on the basis of competitive examination.

Associations and Societies

Engineers' Society of Milwaukee.—At the annual meeting on Oct. 17 this society elected Fred H. Dorner president, F. C. Trubshaw vice-president, Robert Cramer secretary and Walter R. Mueller treasurer.

Commercial National Section, N. E. L. A.—Group meetings of the Appliance, Lighting, Power and Transportation Bureaus and the customer relations committee of this section will be held at Salt Lake City at 10 a.m. on Nov. 21. There will be a general meeting of the committee at 9.30 a.m. and an executive committee meeting at 2 p.m.

Georgia Electrical Association.—This association will hold its semi-annual convention in Atlanta on Nov. 7. A strong and attractive program has been arranged. James R. Strong, president Association of Electragists International; L. W. Davis, director of promotion, Association of Electragists International; A. L. Atkinson, advertising manager merchandising division, General Electric Company; Samuel B. Hibben, secretary Illuminating Engineering Society, and P. S. Arkwright, president Georgia Railway & Power Company, have promised to address the convention.

Active Winter Planned by New England Merchandising Bureau.—Diversified topical discussions combined with monthly luncheon meetings will feature the work of the Merchandising Bureau of the New England Division, N. E. L. A., during the coming winter. At an organization meeting in Boston, with L. A. Fiorani of the Union Electric Light & Power Company, Franklin, Mass., in the chair, the following subjects and dates were assigned, meetings to be held in Boston on the first Monday of each month: Nov. 5, "Stimulating Christmas Business"; Dec. 3, "Adver-

tising"; Jan. 7, 1924, "Demonstrations and Education of Salespeople"; Feb. 4, "Campaign Committee"; March 3, "Ranges and Water Heating"; April 7, "Refrigeration"; May 5, "Small Appliances." Sub-committee chairmen who accepted appointment at the organization meeting were: Frank J. Allen, Westinghouse Electric & Manufacturing Company, Boston, for Nov. 5; O. R. Underhill, appliance manager Worcester Electric Light Company, for Dec. 3; C. P. Myrick, New England district manager Edison Electric Appliance Company, Boston, for March 3, and R. J. Wilder, sales manager Central Massachusetts Electric Company, Palmer, Mass., for May 5.

Illuminating Engineering Society.—On Oct. 18 the New York Section of this society inspected the lighting and signal system of the steamship *Leviathan*. W. M. Zippler, electrical engineer with Gibbs Brothers, consulting engineers, read a paper describing the installation, which he designed and supervised. Among the subjects from which the section will select its topics at its coming meetings, on the second Thursday of each month from December to May, are lighting in large office buildings, lighting of omnibuses, display lighting in stores, theater lighting with high-power illuminants, lighting in the surgical, ophthalmological and dental professions, effects of better lighting on schoolroom work and on manufacturing and selling, industrial lighting and street lighting.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

American Society of Agricultural Engineers —Great Northern Hotel, Chicago, Nov. 8-10.

Associated Manufacturers of Electrical Supplies—Engineering Societies Building, New York, Nov. 8. Frederic Nicholas, 30 East 42d St., New York.

West Virginia Public Utilities Association —Hotel Kanawha, Charleston, W. Va., Nov. 9-10.

Electrical Supply Jobbers' Association—Hotel Statler, Buffalo, Nov. 12-15. Franklin Overbagh, 411 South Clinton Street, Chicago.

Electrical Manufacturers' Club — Hot Springs, Va., Nov. 14-18. F. L. Bishop, Hartford Faience Company, Hartford, Conn.

Arkansas Utilities Association—Pine Bluff, Nov. 15-16. R. I. Brown, Little Rock Railway & Electric Company, Little Rock.

Electric Power Club—French Lick Springs Hotel, French Lick, Ind., Nov. 19-22. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Southeastern Division, N. E. L. A.—Hillsboro Hotel, Tampa, Fla., Nov. 19-22. Charles A. Collier, Georgia Railway & Power Company, Atlanta, Ga.

Electrical Credit Association, Central Division—Hotel LaSalle, Chicago, Nov. 20-21. F. P. Vose, 1341 Marquette Bldg., Chicago.

American Society of Mechanical Engineers —New York City, Dec. 3-6. C. W. Rice, 29 West 39th St., New York.

National Association of Railway and Utilities Commissioners—Miami, Fla., Dec. 4-7. J. B. Walker, New York Transit Commission, New York City.

American Engineering Council (F. A. E. S.) —Washington, Jan. 10-11. L. W. Wallace, 26 Jackson Place, Washington.

American Institute of Electrical Engineers —Midwinter convention, Philadelphia, Feb. 4-8. F. L. Hutchinson, 33 West 39th St., New York.

Commission Rulings

Variation of 7½ per Cent in Contract Load Permitted.—The Pacific Gas & Electric Company, as lessee of the Sierra & San Francisco Power Company, has been authorized by the California Railroad Commission to collect from the Coast Valleys Gas & Electric Company the regular rates fixed by the commission for the resale of electric power under its recent order fixing rates for the Pacific Gas & Electric Company. This order was issued by the commission on the application of the companies, as principals to a contract for the supplying of electrical energy to the Coast Valleys Gas & Electric Company under a load of 55,000 volts, for an interpretation by the commission of the terms of that contract. The companies were unable to agree upon the character of service and the charges therefor, and the commission has held that the uniform rates for resale of power shall apply under the contract, subject to reasonable conditions, including a maximum variation of load of 7½ per cent of the voltage of 55,000 specified in the original contract between the companies.

Amortization of Excess Purchase Price.—The duty of a commission, in passing on an application for approval of the sale of public utility property and the price to be paid therefor, to protect the interest of the public against building up property accounts in excess of the value of the property transferred was dwelt upon by the Missouri Public Service Commission in a case affecting the Public Service Company of Missouri and the Watts Engineering Company. The commission said: "Properly to protect the public in this instance, it appears that the transfer of the property under consideration herein should be authorized only on condition that the difference between the sale price ($130,000) and the fair value ($114,000) be amortized out of the net income of the Public Service Company of Missouri, available for return, surplus and contingencies, over a period of twenty years, and that no portion of such excess should be charged to the operating expenses of said company or to its capital accounts."

Two Aspects of Deferred Maintenance.—If a public utility, at a time when its rates are sufficient, neglects its property and diverts to other uses the money which it should spend for maintenance, it cannot, in an opinion rendered by the Illinois Commerce Commission *in re* Public Service Company, reasonably expect at a later period to provide funds for such maintenance at the future expense of the public. Under these circumstances the amount eventually needed for such deferred maintenance should neither be capitalized nor amortized by means of special charges imposed upon the consumer. But, on the other hand, the commission says: "Rates may become insufficient by reason of changing circumstances, and considerable time may elapse before new and adequate rates are established. If in that interval the rates are so constricted by public authority that normal maintenance must be temporarily reduced or abandoned, there would seem to be justice in the demand of the utility for a compensating allowance after the proper basis of its rates is finally ascertained."

Recent Court Decisions

Commission in Fixing Rates May Consider Experience of Neighboring Cities.—The Hardin-Wyandot Lighting Company appealed from a decision of the Public Utilities Commission of Ohio fixing gas rates in the city of Kenton. The Ohio Supreme Court, declaring that it will not substitute its judgment for that of the commission and will only interfere with commission findings in cases where the record shows the action of the commission to be unlawful and unreasonable, sustained the commission. Objection was made by the plaintiff to the method followed by the commission in taking into consideration the experience of neighboring cities under similar circumstances in making its findings as to what the amount of sales would be in the future, and it was held that wrong inferences had been drawn therefrom. The court held the method to be a reasonable one and the finding not against the rate of evidence. (140 N. E. 779.)*

Government Inspector an Invitee Entitled to Safe Place to Work.—A verdict against Barton & Company, meat packers of Seattle, sued for damages for personal injury by one Mitchell, has been affirmed by the Supreme Court of Washington State. Mitchell is a United States government inspector, and while inspecting defendant's plant he slipped on the floor and was injured by throwing up his hand in such a way that it came into contact with an unguarded electric fan used for ventilating purposes. The company held that the general rule regarding a safe place to work had no application as the man was not its employee; but the court decreed that, the plant being under the control of the government for the purpose of inspection, the victim was an invitee to whom the company was bound to assume a safe place to work. The defense of assumption of risk was not available and that of contributory negligence was for the jury. (217 Pac. 993.)

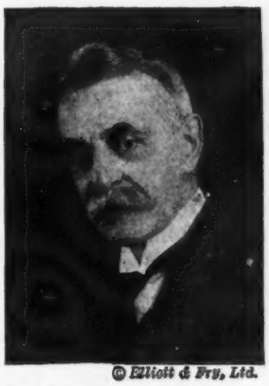
*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

James Swinburne, London Consulting Engineer

James Swinburne, well-known consulting engineer and patent expert of Great Britain, has been associated with the electrical industry in England since 1881. Born at Inverness in 1858, he became an apprentice at the age of sixteen in general engineering works where marine, locomotive and colliery engines were made. After serving his



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JAMES SWINBURNE

apprenticeship he went to the South Shields company's gas works in Jarrow, but was soon attracted to the then infant electrical industry by Sir Joseph Swan, the inventor, who sent him to Paris in 1881 to organize an incandescent electric lamp factory in that city. A year later Mr. Swinburne built one of the first compound, constant-pressure machines, and his work in this connection soon brought him to the attention of the Brush company of Cleveland, Ohio, which invited him to Boston, Mass., on a similar mission. Mr. Swinburne spent 1883 and 1884 experimenting on electric storage batteries and succeeded in reducing sulphate by adding a sodium salt to the electrolyte.

The year 1885 found Mr. Swinburne designing dynamos for Crompton & Company of England, and he subsequently built transformers and instruments and made condensers for supplying idle current. In those years Mr. Swinburne also wrote a great deal on electrical subjects, especially on the theory of dynamo design, alternating-current work and electrical engineering in general. It was in an early article on the theory of multiphase machines that he coined the words "rotor" and "stator," which have been absorbed into several languages. In 1894 Mr. Swinburne opened an office as a consulting engineer in London, and he has since been in demand as a scientific and technical witness, especially in patent cases. He has testified before parliamentary committees for the last thirty-five years. The Institution of Electrical Engineers elected him president in 1902, and similar honors were bestowed upon him by the Faraday Society and the Junior Institution of Engineers. In 1907 Mr. Swinburne was elected a fellow of the Royal Society.

Sir Alexander MacKenzie, president of the Brazil Traction, Light & Power Company, arrived in New York last week. Sir Alexander reported that his company, which furnishes all the traction, light and telephone service to Rio de Janeiro and São Paulo, Brazil, is completing a new 160,000-hp. plant a hundred miles from the former city.

Thomas J. Lucas, electrical and gas engineer of many years' experience and widely known in the public utilities field, has been appointed chief engineer of the Illinois Power & Light Corporation, with headquarters at Chicago. For the last fourteen years Mr. Lucas has been associated with the William A. Baehr Organization, consulting engineers, Chicago. He has been active in the direction of the engineering work of the Illinois Power & Light Corporation since the organization of this company on June 1 of this year.

Dr. Pender to Be First Dean of Moore School of Electrical Engineering

Dr. Harold Pender, whom the provost and the board of trustees of the University of Pennsylvania have, in recognition of his energetic services as director of the department of electrical engineering for the past nine years, appointed as the first dean of the new Moore School of Electrical Engineering, possesses to an unusual degree the qualifications for this new and important post. He has not only had a wide practical experience in the engineering field in connection with varied engineering developments and investigations, but he has also had an extended and successful teaching experience.

Dean Pender was graduated from Johns Hopkins University in 1898. The next three years he spent in graduate work at that institution under Prof. Henry A. Rowland and obtained the degree of doctor of philosophy in 1901. This was followed by several months of important research work in France. Upon his return to this country, he took up practical work in engineering and was connected in turn with the Westinghouse Electric & Manufacturing Company at East Pittsburgh, the New York Central Railroad and with Cary T. Hutchinson of New York City. During his association with Mr. Hutchinson he was engaged in various lines of consulting work, particularly in hydro-electric developments and in the electrification of steam railroads. Following this five-year period in the practical engineering field, Dean Pender was appointed professor of electrical engineering at the Massachusetts Institute of Technology, becoming director of electrical engineering research at that institution in 1913. In 1914 he was called to the University of Pennsylvania as director of the newly created department of electrical engineering.

HAROLD PENDER

Dean Pender is a fellow of the American Institute of Electrical Engineers and has served on a number of its committees, notably as chairman of the standards committee. He has contributed articles on scientific and engineering subjects, is the author of several well-known text books and is the editor-in-chief of Pender's "Handbook for Electrical Engineers."

Nicholas Minorsky, who has been made assistant professor of electrical engineering at the University of Pennsylvania, obtained the degree of electrical engineer from the Imperial Polytechnic Institute, Petrograd, Russia, in 1914, having previously studied at the Naval College at Petrograd and at the University of Nancy, France. On the outbreak of the world war he entered the Russian navy. In 1917 he was the representative of that navy on the Interallied Committee for Inventions in Paris. After the Russian revolution he came to this country and was first employed by the Sperry Gyroscope Company as a consulting engineer and later by the General Electric Company as research engineer at Schenectady. Since December, 1921, he has been engaged in development work for the Bureau of Construction and Repair, U. S. N.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Distribution—the Manufacturer's Viewpoint*

A Discussion of Some of the Complexities That Confront the Man Who Must Develop Machinery for Distributing Electrical Products

By J. S. Tritle
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Westinghouse Electric & Manufacturing Company, New York

THE problem of distribution is, in my opinion, the greatest problem which faces the electrical industry today and is, of course, of the greatest importance to the consuming public. In 1910 there were approximately a thousand manufacturers of electrical devices of one kind or another. Today there are more than 4,600. The consequent result is that manufacturers of very large capacity are seeking in various ways a market for their products. This market, exclusive of central stations and non-electric stores, is formed as follows:

There are between 450 and 500 electrical supply jobbers—or, in other words, a jobber for every ten manufacturers.

There are between 15,000 and 20,000 electrical contractors and dealers—which means a jobber for approximately every forty contractors and dealers, there being so many manufacturers and so many jobbers, contractors and dealers that an exceedingly intensive competition has been developed to obtain a market for the product which each is handling.

J. S. Tritle

Loss Through Incompetence

The result is that a large percentage of business is being placed on price alone, very little attention being paid to quality or trade relations or in some cases to what might be called business ethics.

To obtain a contact with the public many concerns have entered the industry without any fundamental knowledge of it from the standpoint of ability to manage the business or knowledge of the cost of operating expenses. The men who go into the business with a limited knowledge often prove ultimately incompetent, thus staying in business but a short time, and add greatly to the cost of distribution.

For instance, records this year show that more than 3,000 electrical contractors, dealers and contractor-dealers have failed in business. Estimating the loss of their own capital and their indebtedness to creditors at the very lowest calculation as $1,000 each, there results a total loss to distribution of $3,000,000, for which the consumer ultimately must pay, and this represents only a fraction of the economic loss which comes to the industry because of taking the profit from those organizations with well-established credit and knowledge of the business. There is also a loss to the electrical industry in addition because of incomplete installations following the sale of many thousands of dollars' worth of electrical appliances.

The problem of the manufacturer is to obtain, through his wholesale and retail distribution, outlets to the public which must continue prosperous in order to continue the work of electrical development; for it cannot proceed through outlets which are not making money. To create a market for these goods the manufacturer needs outlets which can do constructive work, or, in other words, make two blades of grass grow where but one has grown before. In electrical terms, this might mean men who will install two convenience outlets where the incompetent would install but one. Through such outlets a greater market will be created to absorb the vast manufacturing capacity of the electrical industry, and only through such men, understanding their business and coming into contact with and instilling confidence into the public, will economic distribution at lowest selling costs be attained.

Loss Through Many Lines

An example recently came to our attention where a company said that it could not make money on its retail appliance business on account of the discount being too small. Investigation showed that this concern was handling irons with nineteen different trade marks and of more than twenty-five different styles and designs, making it not only necessary to carry this large investment, but absolutely impossible to secure a sufficient turnover to enable it to handle irons at a profit. This also necessitated the endeavor to educate the salesmen on the talking points of the different and various irons, and these salesmen, of course, were supposed to educate the consumers. It has been proved impossible in the past to educate salesmen to perform high and efficient sales service while endeavoring to sell a large number of different lines.

In the past investigations have shown that many failures have been attributable to carrying too many lines so that a sufficient turnover could not be made. Therefore it appears that in order to make a success it would be necessary to standardize on a limited number of lines,

*A paper presented before the Association of Electragists International, Washington, D. C., Oct. 11. 1923.

which would cut down the investment, increase the stock and capital turnover enormously, and ultimately yield a profit instead of a loss.

BURDEN OF RESELLING

The manufacturer is faced with many facts in arriving at his cost. In addition to the cost of labor and raw material, both of which have increased enormously, he must provide a certain percentage for development expense, in order to continue to bring out new and more efficient lines and also receive a fair rate of interest on his investment. In order to help the dealer—the one who sells to the public—there are many expenses, such as national advertising, periodical advertising, newspaper advertising, sales helps, education of jobbers and retail salesmen on his lines, contribution to electrical trade organizations and associations, and various other expenses necessary to develop the market and help the retailer sell to the ultimate consumer with the smallest amount of time and the least sales resistance.

Some manufacturers at the present time are selling appliances, one might say, three times—that is, first, to the jobber, necessitating the education of jobbers' salesmen; second, by helping the jobbers' salesmen to get retail outlets, and, third, by helping to educate the dealer and endeavoring to see that the right "set-up" is made to assist him to sell to the ultimate consumer. All this has apparently proved necessary, but one may wonder whether it is appreciated and is economically correct. Again, are the manufacturers who are doing this performing a service that is economically unsound?

It is felt that there is a strong obligation on the part of the manufacturer to cut the cost of distribution to the consumer and at the same time provide an adequate profit for the man who is wholesaling and retailing his product. The question is how this can be done if the present "spread" is not sufficient. There have been only three ways suggested. First, the establishing of a consumer cost which is sufficiently high to give a larger spread to the dealer. This would necessitate the raising of list prices, which certainly would have a tendency to curtail consumer demand. The second way would be to increase the discount on the present consumer prices—a step which, from our experience, cannot be taken today on account of the cost of labor, material and sales expense. The third possibility would lie in the direction of a reduction of selling expense by more intelligent application of the economic principles underlying retail business. There must be a better understanding on the part of the dealer of those fundamentals which govern the profitable conduct of retail business, such as stock movement, stock records and accounting methods, all of which should enable him to secure a rate of stock turnover on a given basis of present margin to yield a fair net profit.

MANUFACTURERS' RESPONSIBILITIES

In considering such possibilities, however, it must be remembered that there are some very definite responsibilities which the manufacturer must meet. The manufacturer must put on the market only devices of such a grade as will reduce the possibility of any trouble to an absolute minimum, and he must stand back of such apparatus in every way, so that the consumer will be entirely satisfied and not force the retailer to be burdened with the cost of replacements and the necessary time to keep the appliances sold. The manufacturer must continue—for the present at least—to spend large sums of money in order to promote the sale of his lines, ascertain the demand, demonstrate the applications and see that service is given to the consumer where necessary. All of the above requires not only a large investment but also a large sales and office personnel.

The manufacturer, also, it seems, must continue national advertising in order to popularize appliances, as well as trade paper and newspaper advertising all over the country in order to promote sales and make retail distribution easier for the retailer. And the manufacturer, for the present at least, will have to continue doing extensive work to educate the retail sales clerks behind the counter, in order to enable them to make better salespeople of themselves and thus increase the sales of appliances at the lowest possible cost to the retailer. All these are and must continue to be important elements governing the price of electrical commodities.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

THE most interesting bit of news of the trend of the trade this week comes from the Eastern district, where there has been a marked improvement in the demand for appliances. Heaters, flatirons and hollow ware have been selling strongly. Holiday buying has set in again after the lull, and it is expected that it will now carry through. Wiring materials are not so active, and wire has fallen off considerably.

Chicago reports brisk business, with no important price changes other than a 5 per cent increase in switch boxes. Conduit orders are growing. In the South the retailers say that the period of slow buying continues, but jobbers are busy and confident. Stocks are good, with excellent prospects for holiday trade. In the Far West business has also been quiet. Power-company buying is tapering off. Retail sales show improvement.

American Electric Firms' Control of Japanese Market

ELECTRICAL development in Japan has made great progress during the last few years. Although hydro-electric power is depended upon principally, it has been found advisable to supplement this with steam plants so as to guard against possible shortages of water in the streams during dry periods. The Tokyo Electric Company had its plans well advanced for the construction of a new power plant of 150,000 hp. at Tokyo just before the earthquake. It had placed an order with an American company for equipment for the proposed plant, which with buildings will cost approximately 8,000,000 yen, equivalent to $4,000,000 United States money. It is stated that not only will this plant be built according to original plans but that several million dollars additional will be spent by the company for material with which to rehabilitate its system. The earthquake did much damage to the company's property, but the reconstruction work will enable the modernization of the older parts of the system in many respects, it is explained. The Tokyo Electric Company is the largest corporation in all Japan. It has a total subscribed capital of 222,000,000 yen, equivalent to $111,000,000 United States money. Much of the company's expansion has taken place during the last three years, during which time it has absorbed nine competing companies and added 121,000,000 yen to its capital.

Next to the Tokyo Electric Company in magnitude of operations is the Toho Electric Power Company of Nagoya, which has a capital stock of 140,000,000

yen, equivalent to $70,000,000 United States money. This company is preparing to construct a hydro-electric plant on a river at Najima, between the cities of Hakata and Fukuoka. It has placed an order for equipment with the Westinghouse company. The Toho company's expansion and improvement plans call for the expenditure of several million dollars, it is stated. The new plant will furnish power and light for a number of industrial centers. The Toho Electric Railway Company will also receive power from this source for the operation of several interurban electric railway lines which it plans to build.

In the city of Kobe the municipally owned electric railway system is to be extended, an appropriation of 12,280,000 yen having been made for the purpose. Involved in this project is the widening of several streets.

An expansion plan of much magnitude has been adopted by the Daido Electric Company of Osaka. Its principal plant is on the Kiso River, and from it power is brought to Osaka to the amount of 70,000 volts. At the time the earthquake came this company was working on the proposition of extending its power transmission system to Tokyo, 300 miles, and of entering into active competition with the Tokyo Electric Company.

In a number of the larger cities of Japan the tramway systems are municipally owned. The three tramways in Tokyo were purchased by the municipality in 1911 at a cost of 63,915,000 yen, equivalent to $31,957,500 United States money. The combined system had about 200 miles open to traffic at the time of the earthquake. Much of this will have to be rebuilt, it is stated. The municipality of Tokyo also operates the electric lighting system of the city.

Notwithstanding the fact that strenuous efforts are being made by German manufacturers of electrical machinery and equipment to regain their pre-war position in the trade of Japan, the situation there is such that American manufacturers will have the best of it for some time to come. Alliances or co-partnerships have been entered into between the principal Japanese manufacturers of electrical machinery and equipment and foreign makers. The General Electric Company has formed a combination with the Shibaura Electric Works; the Westinghouse Electric Company has formed a combination with the Tokyo Denki Electric Works; the Western Electric Company has formed a combination with the Nippon Dento Electric Works, and the Siemens-Schuckert Company has formed a combination with the Furukawa Electric Works.

Generator Business Is Expected to Reach 30 per Cent Over 1922

ORDERS on the books of manufacturers of large generators show increasing business, which is expected to push the total yearly sales up to between 25 and 30 per cent over those of 1922. Deliveries are running at a more normal stride, between twelve and thirteen months. Deliveries in the heavy-generator business for July of this year were reported as running at from two to three months longer, because of labor conditions, and the total amount of business for the year 1923 was expected to show an even 20 per cent increase. The feature of the present market is the recent improvement in labor conditions, which is considered a most favorable situation for the makers as orders for 1924 and 1925 deliveries are record-breaking.

A gradual improvement in this business has been reported since the fall of 1922, when the central-station companies were receiving their first worthwhile appropriations for extensions and improvements after the depression of 1920. The earnings statements of the large manufacturers of heavy electrical machinery during the first six months of this year were only slightly higher than for the corresponding period of 1922, but, judging present business and the amount of orders received by the leading makers during the third quarter, earnings will be considerably larger than for last year because of the increased business as the larger volume is expected to do more than offset the slightly higher labor rates.

Radio Authority Says Trade Is Still Unsound

THE present situation in the radio field is still unsound from both an engineering and an economic standpoint in the opinion of W. E. Harkness, manager of the radio department of the American Telephone & Telegraph Company, as expressed at the recent meeting of the Radio Trade Association at the Grand Central Palace.

"It is generally conceded," Mr. Harkness said, "that there are an excessive number of broadcasting stations at present. It is, however, of interest to note that there is a marked falling off in the number of licenses issued by the Department of Commerce during the present year and also a decided decrease in the number of stations in service. A total of 847 licenses has been issued, and the total active is 565, or a decrease of 32.2 per cent. This is encouraging for future development of the art, as the principal reason for the decrease is the realization of the cost of installing, maintaining and operating radio broadcasting stations."

In reviewing the conditions in the radio trade during the past year, H. Gernsback declared that the year just past "has kept the trade busy cleaning up the wreckage left over by the boom which started early in 1922."

The meeting, presided over by Henry M. Shaw, president of the Radio Association, was one of the features of the Radio Exposition held from Oct. 6 to 13. About ninety manufacturers and dealers were represented at the exposition.

Value of Delinquent Accounts Was Lower in September

DELINQUENT accounts as reported by the National Electrical Credit Association for both the Central and New York Divisions decreased in September, 1923, from August, 1923. In the Chicago territory the total amount for the above-named period went from $114,261.15 to $95,252.94. However, the number of accounts increased twenty-one. For New York both the total amount and the average amount decreased, following a reduction in the total number of accounts of fifteen.

DELINQUENT ACCOUNTS IN SEPTEMBER

Branch and Month	Number of Delinquent Accounts Reported	Total Amount	Average Amount
Central Division:			
Aug., 1922	773	$104,433.30	$153.94
Aug., 1923	739	114,261.15	154.61
Sept., 1922	882	98,818.90	112.04
Sept., 1923	760	95,252.94	125 33
New York:			
Aug., 1922	578	79,764.00	138.00
Aug., 1923	380	70,770.00	186.00
Sept., 1922	530	78,739.00	149.00
Sept., 1923	365	61,731.00	169.00
Philadelphia:			
Aug., 1922	258	37,013.70	143.47
Aug., 1923	176	20,660.96	117.39
Sept., 1922	264	39,060.19	147.96
Sept., 1923	246	27,955.15	113.64
New England:			
Aug., 1922	63	9,491.30	150.65
Aug., 1923	54	5,117.10	94.76
Sept., 1922	124	13,045.43	105.20
Sept., 1923	56	8,156.49	145.65
Pacific Coast:			
Aug., 1922	21	3,450.23	154.77
Aug., 1923	17	2,583.80	151.99
Sept., 1922	19	3,002.57	157.95
Sept., 1923	26	6,998.20	269.16

In the Philadelphia territory the number of delinquent accounts for August and September of this year increased from 176 to 246, although the average amount was only $3.75 lower for September. In both the New England and Pacific Coast territories the total number of accounts, the total amount of money involved and the average amount increased in September over August, 1922. The accompanying table gives the complete record.

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0337	$0.0337	$0.0292
Cold finished shafting, per lb.	0.0433	0.0433	0.0378
Brass rods, per lb.	0.165	0.17	0 171
Solder (half and half), per lb.	0.262	0.276	0 2283
Cotton waste, per lb.	0.1225	0.1225	0 1458
Washers, cast iron (⅛-in.), per 100 lb.	4.66	4.66	4.33
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.08	3.08	2.96
Machine oil, per gal.	0.349	0.349	0.36
Belting, leather, medium, off list	37%	37%	44½%
Machine bolts, up to 1-in. x 30-in., off list	49½%	49½%	49%

Electrical Plants Produced 56.8 per Cent of Capacity in 1921

MANUFACTURE of electrical machinery, apparatus and supplies during 1921 was at a rate slightly more than one-half of the capacity of the industry. Had conditions been such as to make possible the maximum output, electrical machinery and apparatus to the value of $1,469,398,706 would have been manufactured in that year. Instead, the value of products at the 1,333 plants engaged in such manufacture was $833,985,443, or 56.8 per cent of the possible output.

The figures just have been made public by the Bureau of the Census. They were compiled as a result of recommendations by the committee on census schedules created at a conference of trade associations, which met in Washington in 1921 at the instance of the National Association of Manufacturers. Nathan B. Williams was chairman of the committee.

Industry	No. of Establishments	Value of Products	Possible Output	Per Cent of Possible Output
Cars, electric railway*	10	$14,856,068	$40,165,004	37.0
Cars, electric†	560	87,312,426	99,719,090	87.6
Electric and gas fixtures	308	42,889,905	75,037,852	57.2
Signs‡	624	53,270,864	83,558,008	63.8

* Not including operations of railroad companies.
† Representing construction and repairs by electric railway companies.
‡ Not exclusively electric.

The percentage of possible output among all of the industries shown on the return was 56.8. This covers 194,194 establishments, with a combined value of products of $42,318,241,453. Had these plants worked at maximum capacity, they would have produced $74,123,930,736.

Other figures of electrical interest are included in above table.

New England Electrical Manufacturers Busy Filling Orders

ELECTRICAL apparatus and appliance production on a large scale characterize this week's report from New England, with jobbers handling a substantial volume of business of diversified character. Collections are slowing up a little, and construction projects are not quite so active in coming to the contract stage. Some wholesalers state that their total volume of fall business has not come up to expectations, but fundamental conditions are strong, with comparatively little lack of employment, heavy railroad traffic, an immense demand for telephone and central-station service and a fine and expanding retail trade, especially in electrical lines.

Prices weakened on both rubber-covered and weatherproof wire over the week end. Heavy-appliance makers are showing some anxiety over electric range delivery prospects, and the demand for table appliances and fixtures is lively in the extreme. Loom sales to Maine are a noticable item. The new Boston ruling prohibiting opening streets for routine underground construction during the winter is quickening the efforts of utilities to complete as much of this work as possible before freezing weather.

Improvement Noted in New York Market After Buying Lull

MUCH improvement in this week's market is reported by New York jobbers. This betterment is decidedly encouraging because it is unanimously agreed that the buying which has developed during the last four days has been of a more permanent character, with orders in heavy amounts and very firm prices.

The bulk of the business, however, is that of appliances which manufacturers are advertising to the greatest extent in the history of the industry, and which are being manufactured at production records. Dealers are now taking larger amounts of all heating devices, especially hollow ware, which are selling at an unprecedented rate.

Wire prices are slightly softer, motor business is not improved, central-station orders are still strong, poles are moving quickly, and lamp sales are constantly increasing.

Chicago Buying Steady; Conduit Purchasers Coming Into Market

GENERAL business conditions remain about the same this week, and the electrical trade as a whole is anticipating exceptionally good business this fall. October started in briskly, and so far this month is surpassing September and August. No important changes in prices were announced this week, with the exception of an increase in switch boxes of about 5 per cent, which will go into effect some time next week. Sales of pole-line hardware, poles, high-tension equipment, etc., have been rather good, but no exceptionally large orders have been reported. Conduit sales have increased considerably, and indications are that buyers are coming into the market on this commodity. This is probably due to the fact that purchasing had been somewhat curtailed during the summer months.

San Francisco Retail Sales Stronger—Market Lags

RETAIL store business is much improved and sufficient ground for encouragement is found in the sounder methods everywhere prevalent, especially in the marketing of the larger household appliances. It is interesting to note that the holiday buying is not being unduly rushed, which is in strong contrast to the efforts of jobbers during the last three years.

Power company business is tapering off somewhat, but the year 1924 promises a tremendous volume through the construction of lateral lines and the sale of energy-consuming devices. Pole-line hardware is moving in good volume.

Unusually late weather has enabled building to be carried on without cessation. The long-predicted building slump has not materialized and conditions are improving every day. Next year's electrical business promises to be even better because of increased real-estate sales totaling a 50 per cent increase for San Francisco alone.

Atlanta Retailers Report Business Slowed Up Since September

ELECTRICAL retailers report that business has slowed up since the first of September, and this is attributed to the falling off in building activities and to the fact that purchasers are saving up for the holidays. While the retailers expect a good holiday business, they are hesitant about anticipating their requirements and placing orders accordingly. Instead, they seem to expect the jobbers to carry the stocks and be able to make immediate deliveries on their hand-to-mouth orders.

All jobbers believe business is unusually good, and the only change since last week is a price reduction of 2 cents per pound on weatherproof wire announced by one of the largest jobbers. Good stocks are the rule, except in flatirons, but large orders are placed for this item and shipments are expected shortly. The entrance of the central stations in the merchandising field has resulted in an excellent movement of all the types of domestic heating appliances.

The Metal Market

STRENGTH is noticeable in the copper, lead and zinc markets, owing principally to the strength of the London prices. All three of these metals advanced during the week in the chief European market, which has helped to check the decline in copper, to increase the demand for American slab zinc abroad and to remove the slightly softer tendency in the lead market.

Whether a definite turn for the better has taken place in the copper market is difficult to say. Sales have been light with only moderate tonnages bought. At the moment the tendency of the copper market is downward and much depends on the attitude of the London market.

NEW YORK METAL MARKET PRICES

	Oct. 17, 1923 Cents per Pound	Oct. 24, 1923 Cents per Pound
Copper, electrolytic	13.00	13.00
Lead, Am. S. & R. price	6.85	6.85
Antimony	7.75	7.62½
Nickel, ingot	27.00 to 32.00	27.00 to 32.00
Zinc, spot	6.25	6.35
Tin, Straits	41.75	41.50
Aluminum, 98 to 99 per cent	26.00 to 27.00	26.00 to 27.0

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Western Electric Gains

In the first nine months of 1923 the Western Electric Company's billings totaled $178,750,000, which was $26,233,000 more than for the 1922 period. This is at the rate of around $235,000,000 for the year 1923, and compares with $211,000,000 for 1922. Orders booked in the first nine months total $211,185,000, or $77,064,000 more than in the 1922 period.

Carney Establishes Creosoting Plant and Pole Yard

A new creosoting plant and pole yard has been established by B. J. Carney & Company, producers of Western red-cedar poles, on the Soo Line in northwestern Minneapolis at Forty-seventh Avenue and Osseo Road. About ten acres of advantageously situated ground has been set aside for this work. Although the treating plant will not be ready for operation until about Dec. 1, poles are already being received daily so that the plant will be in a position to handle orders for treated poles at that time.

Range Campaign in Northwest

Ralph J. Cordiner of the Edison Electric Appliance Company, Chicago, is spending several weeks in Spokane in connection with sales of "Hotpoint-Hughes" electric ranges in that territory. Mr. Cordiner states that six of the leading power companies in the Northwest are now conducting range campaigns and that the sales already made indicate that a great success is to be attained.

This is the first time that such campaigns have been carried out in the autumn months, and the results confirm Mr. Cordiner's conviction that the market for electric ranges is one that is open throughout all the year and merely needs stimulation to be productive.

Electric Service League of Canada Enlarges Board

The Electric Service League of Toronto, Canada, incorporated to conduct electric homes in Canada, has enlarged its board of directors from five to twelve. It consists of the following men: A. S. Edgar, manager supply department, Canadian General Electric; E. M. Ashworth, acting general manager Toronto Hydro System; C. S. Barthe, Canadian General Electric; F. John Bell; W. R. Carr, editor *Electrical News;* R. A. L. Gray, contractor-dealer; J. Herbert Hall, Conduits Company; C. H. Hopper, Canadian Westinghouse Company; R. T. Jeffery, Hydro-Electric Power Commission of Ontario; C. A. McLean, Masco Company; W. R. Ostrom, district manager Northern Electric Company, and A. W. J. Stewart, Toronto Hydro-Electric System.

Doble Engineering Company Moves Offices

The Doble Engineering Company, Boston, has transferred its offices to 110 Brookline Street, Cambridge, Mass., where increased space for all phases of the company's business and close contact between office and factory will be available. F. C. Doble states that interest in live-line insulator testing is increasing throughout the country among both operating organizations and insulator manufacturers.

Business of Walworth Company Is Increasing

The Walworth Manufacturing Company, Boston, manufacturer of valves, is reported certain to show earnings of not less than $7 a share on its $4,000,000 common stock this fiscal and calendar year. While not up to the exceptional volume of the first half of the year, business is continuing at a satisfactory rate. Sales to date amount to about $14,400,000, compared with $9,500,000 for the same period a year ago and with $13,500,000 for all of 1922. The prospects favor at least $18,000,000 of gross business for the full 1923 year. Some departments of the business are slowing down, but others are unable to keep abreast of incoming orders.

Increase Telephone Output

The possibility of any let-up in the production of telephone apparatus required to continue the expansion of the country's communicating system seems out of the question for years to come, according to executives of the Hawthorne factory, Western Electric Company. Instead of easing up, the demands for new equipment continue to grow at such a rate that the works management is finding itself forced to extreme measures to live up to its output schedules.

The production of telephone transmitters this year, it is pointed out, will exceed 1,500,000—an increase of almost 40 per cent over the record output of a year ago. The transmitter is one of the most important parts of the subscriber's telephone. Increased deliveries in all the other branches of telephone equipment are also being recorded at Hawthorne.

General Electric Meter Convention

Fifty meter specialists, including commercial representatives, designing and other factory engineers of the General Electric Company, held a four-day meeting, beginning Oct. 2, at the New Ocean House, Swampscott, Mass., under the general chairmanship of F. G. Vaughen, sales manager meter department, Schenectady works. Three daily sessions were held and the following program of papers and subjects discussed was carried out:

Opening remarks, F. G. Vaughen; "Alternating-Current Meters," W. M. Howe; "Direct-Current Meters," H. G. Hamann; "Special Metering Problems," H. M. Witherow; "Magnets," I. S. Kinnard; "Oils," W. E. Porter; "Developments in Watt-Hour Meters," W. H. Pratt; "The Meter Specialist," B. P. Burleigh; "Methods of Business Getting," C. S. Kammerer; "Demand Meters," J. A. Laubenstein; "Development of Demand Meters," C. I. Hall; "Competition," L. E. Northshield; "Instruments," S. H. Bowman; "Instruments, Miniature and Refinements," W. E. Porter; "Development of Instruments," W. H. Pratt; "Instrument Transformers, and Air Insulators," L. Arnold; "Two-Stage Transformers," W. K. Dickinson; "Oil-Insulated Instrument Transformers," R. W. Francis; "Testing Methods," S. G. Hamann; "Production," A. W. West; "Manufacturing Methods, Lynn," W. J. Lloyd; "Manufacturing Methods, Fort Wayne," F. C. Morganthaler. In addition there was a general discussion of manufacturing problems in which shop foremen, leading men and others participated.

Apex "Money Talks" Contest Creating Many Sales

The Apex Electrical Distributing Company, Cleveland, manufacturer of household appliances, is holding a sales contest until Jan. 1. This is called "Money Talks Sales Contest," and with nine automobiles and cash bonuses as prizes, officials of the company say that records have reached a high mark since the contest began on Sept. 1. The chief reason for the intense interest by the salesmen, it is said, is the basis on which contest credit is given, the number of points per sale varying with the amount of "down payment" obtained by the salesman.

Two Ohio Signal Device Makers Announce Consolidation

Consolidation of the Tele-Call Company, Cleveland, and the Autocall Company, Shelby, Ohio, has been announced. These firms are manufacturers of signaling systems, and their products cover practically the same fields. The Tele-Call Company has confined its efforts almost entirely to paging service, while the Autocall Company is the maker of fire alarms and watchmen's local supervisory services.

For the present both plants will be operated independently, and the com-

panies will gradually become merged under the name of the Autocall Company, with headquarters at Shelby. W. W. Van Horn is president and C. C. Skiles vice president and general manager.

Japanese Plant Gains 10 per Cent

The Kawasaki plant of the Tokyo Electric Company reports that its present output is 10 per cent in excess of its capacity at the time of the earthquake.

This company, affiliated with the International General Electric Company, manufactures electric lamps, wiring devices and meters. Although seriously damaged in the recent catastrophe, it is now engaged in turning out electrical supplies immediately needed for reconstruction.

Valley Electric Appointments

The appointment of E. W. Martin as Chicago district manager has just been announced by the Valley Electric Company, St. Louis, manufacturer of single-phase and polyphase ball-bearing motors, rectifiers and other electrical products. Mr. Martin goes to the Valley organization from the Westinghouse Electric & Manufacturing Company, with which he has been associated for a number of years in various capacities.

Appointment of C. L. Krentz in the sales department of the home office in St. Louis is also announced by the Valley Electric Company.

Allis-Chalmers Company Order

The St. Louis office of the Allis-Chalmers Manufacturing Company has recently received an order for a 1,500-hp. rolling-mill motor from the Scullin Steel Company of St. Louis. It is to be installed in theManchester Avenue plant of the Scullin Steel Company, and it is expected that the motor will be delivered Feb. 1, 1924.

Westinghouse to Have New Warehouse in Kansas City

The Westinghouse Electric & Manufacturing Company recently awarded a contract for the construction of a new warehouse in Kansas City to Miller & Stauch, contractors, to cost $61,500.

The building is to be erected on an irregular tract of ground lying between Wyandotte Street and Scott Avenue just north of Milwaukee Avenue. The building is to be of concrete construction and will be three stories high, each floor having 30,000 sq.ft. of floor space.

Long Island Railroad Order for Electrical Equipment

As part of its program to improve service to provide for increased traffic anticipated next summer, the Long Island Railroad has given the Westinghouse Electric & Manufacturing Company an order for electrical equipment for sixty passenger cars. Each equipment consists of two 225-hp. motors and necessary multiple-unit control apparatus. The amount involved is approximately $600,000.

In addition to these cars, which will be ready for delivery next spring, fifty more, previously ordered, will be ready this year.

York Insulated Wire Extends Pittsburgh Territory

The York Insulated Wire Works, 1737 Broadway, New York City, have recently extended the territory of their Pittsburgh agent, H. Lee Reynolds, Oliver Building, to all of the State of Ohio as well as the Detroit district. The Reynolds firm has represented York Insulated in the sales of "Salamander" asbestos insulated wires for some time past. For the convenience of customers in Ohio, all mail addressed to 309 Plymouth Building, Cleveland, will receive prompt attention.

Motor Lecture in Spokane

On Oct. 5 the Spokane (Wash.) office of the General Electric Company gave a dinner at the Davenport Hotel attended by the leading men of the electrical industry in Spokane. S. E. Gates, local manager of General Electric, presided and introduced as speaker for the evening E. C. Fellows, motor specialist in the Seattle office, who gave an illustrated talk on the subject of improvements in General Electric motors.

W. L. Rose Equipment Company Moves Into Larger Offices

The offices of the W. L. Rose Equipment Company, St. Louis, were moved on Oct. 15 from the La Salle Building, at Olive Street and Broadway, to the New Planters' Building, at Fourth and Pine Streets. This company has had offices in the La Salle Building ever since organization ten years ago, and the business has grown to a point where larger quarters are necessary. This company is the manufacturers' agent in St. Louis for many standard lines of high-tension equipment.

Brandes Secures More Space in New York

C. Brandes, Inc., 237 Lafayette Street, New York City, announces the lease of another 5,000 sq.ft. of space in the building in Lafayette Street.

This is the third addition that the company has made in the past year. Early in March it leased the ninth floor, consisting of 5,000 sq.ft. of floor space. In August it purchased a new plant in Newark containing about 48,000 sq.ft. With the newly leased space, the company occupies four floors of the building. The main office will be continued at 237 Lafayette Street.

Western Union Telegraph Net Income Shows Increase

Net income for the nine months ended Sept. 30, 1923, of the Western Union Telegraph Company amounted to $10,000,504 as compared with $9,473,844 for the corresponding period of 1922. The detailed account of the earnings report of the company is as follows:

	1923	1922
Gross revenues, including dividends and interest	$84,878,754.00	$78,783,925.00
Maintenance: Repairs and reserved for depreciation	$13,679,844.00	$12,694,523.00
Other operating expenses, including rent of leased lines and taxes	59,468,269.00	54,885,421.00
Total expenses	$73,148,113.00	$67,579,944.00
Balance	$11,730,641.00	$11,203,981.0
Deduct: Interest on bonded debt	1,730,137.00	1,730,137.00
Net income	$10,000,504.00	$ 9,473,844.00

The Standard Electric Stove Company, Toledo, Ohio, will remove its business to Goshen, Ind., where a portion of the plant of the Engman-Matthews Range Company has been leased. The capacity of this plant will be increased.

The J. P. Davis Company, 159 North State Street, Chicago, is now the exclusive selling agent of the American Enameled Magnet Wire Company, Muskegon, Mich., in Illinois and Wisconsin.

The Electric Appliance Company, Dallas, Tex., has been reorganized and merged with the Electric Specialty Company. The new company will be known as the Electric Appliance Company, and M. E. Martin will be president of the merged company. The merger results in the addition of $90,000 in new capital to the Electric Appliance Company, which will conduct a wholesale business in electrical supplies. Charles L. Martin is secretary of the company and general manager of the new organization.

The Ludlow Battery Service Company, 421 South Ludlow Street, Dayton, Ohio, has acquired additional property and contemplates the construction of an addition to its plant, to be built at Ludlow and Franklin Streets. J. C. Melat is president.

The H. T. Electric Company, 612 North Capitol Avenue, Indianapolis, has completed plans and will take bids at once for the construction of its proposed new plant on local site, estimated to cost approximately $30,000.

The Mazda Lamp Division of the General Electric Company has posted notices to its employees at Central Falls, R. I., that it will close its plant there within a month. The lamp making will thereafter be done at a new plant in East Boston. The company has been in business in Central Falls since 1907 and has employed from 350 to 600 persons. The payroll now approximates $8.000 weekly.

Foreign Trade Notes

FARM LIGHTING PLANTS IN CEYLON VILLAGES.—Plans are under way, *Commerce Reports* states, to provide electricity for lighting in certain small towns and villages of the island of Ceylon by means of oil-engine-driven self-contained generating unit (really the larger types of home-lighting plants). The scheme is being fostered by the government agent of the western provinces, where five such plants are being installed, following the success of the plant that has been operating in the village of Gampaha, which has gained much favor in the western provinces. It is expected that the system will be extended to other parts of the island. A list of the principal towns of the different provinces at which government agents are located may be obtained from the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., or through any of the bureau's district or co-operative offices by referring to file No. 106,994.

PROPOSED HYDRO-ELECTRIC PLANT AT PONT DE MONTEVERT, FRANCE.—Application has been filed by the Paris, Lyons & Mediterranean Railway Company for a concession to utilize the water at Mont Lozère and to build a 20,000-hp. generating plant at Pont de Montevert, with a view of equipping the railway from Langogne to Alais for electrical operation.

PROPOSED HYDRO-ELECTRIC PLANT NEAR MADRID, SPAIN.—Plans are being prepared by the Sociedad Electro-Metalurgica for a hydro-electric plant on the Aberche River, near Madrid. The power will be used mostly for industrial purposes.

PROPOSED HYDRO-ELECTRIC PLANT FOR CHRISTCHURCH, NEW ZEALAND.—A report giving the details of the proposed hydro-electric development on the Waimakariri River at Otarama Gorge, near Christchurch, has been submitted to the City Council of Christchurch by Charles B. Hawley & Company, Washington, D. C. The plans provide for an initial generating capacity of 15,000 kw., to be increased to 22,500 kw., and an ultimate capacity of 45,500 kw. The cost of the project is estimated at £838,600.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Bydgoszcz, Poland (No 7,974), of copper wire.

TRANSFORMERS AND CABLES FOR THE MORWELL (AUSTRALIA) POWER SCHEME.—Tenders will be received by the State Electricity Commission of Victoria, Melbourne, Australia, until Jan. 3, 1924, for aluminum steel-cored cable and accessories (Specification No. 24/1). Tenders will also be received by the commission until Dec. 15 for four 1,000-kva., single-phase transformers and spares (Specification No. 23/145) for the Morwell power scheme.

New Apparatus and Publications

SIGN FLASHERS.—The Reynolds Electric Company, Chicago, has issued bulletin No. 41, which gives general information on maintenance and installation of "Reco" sign flashers.

TACHOMETERS.—The Bristol Company, Waterbury, Conn., is distributing bulletin No. 317, covering its recording and indicating tachometers.

ELECTRIC DISHWASHER.—A new high-speed automatic dishwasher for hotels, hospitals, restaurants, etc., has been developed by the Crescent Washing Machine Company, New Rochelle, N. Y.

ELEVATOR MOTOR.—A two-speed alternating-current motor for use with high-speed elevators has been brought out by the Warner Elevator Manufacturing Company, Cincinnati.

CABLE BENDER.—A cable bender for bending and straightening large-size cable in underground construction has been developed by T. J. Cope, 2112 Sansom Street, Philadelphia.

ELECTRIC TRUCK.—A new type of industrial truck, known as the reel-handling truck, has been developed by the Automatic Transportation Company, Inc., 2933-2965 Main Street, Buffalo. This truck meets a great need in the wire industry and is built in capacities of 6,000 lb. and 10,000 lb.

CABLE AND CORD.—The Rome Wire Company, Rome, N. Y., is distributing two folders, one describing its superservice welding cable and the other its superservice junior cord.

ELECTRIC OVENS.—Catalog No. 4 issued by the Despatch Manufacturing Company, Minneapolis, describes and illustrates the "Despatch" electric ovens for all purposes.

RADIO APPARATUS.—A new piece of radio apparatus has been brought out by C. Brandes, Inc., 237 Lafayette, New York City, under the name of "Brandes Table-Talker," which is virtually a loud speaker.

GRINDING MACHINES.—Bulletin No. 1,305 distributed by the Hisey-Wolfe Machine Company, Cincinnati, covers the "Hisey" ball-bearing grinding machines.

MAGNETIC RELEASE VALVE.—The Penn Electric Machine Company, Des Moines, Iowa, has placed on the market a magnetic release valve for air compressor service.

MAGNETIC RELAY SWITCH.—The Trent Electric Company, 1,524 Chestnut Street, Philadelphia, has brought out a new magnetic relay switch.

ELECTRIC THERMOSTAT.—A new thermostat "Caliscope" has been developed by the American Teletherm Company, 1017 Summit Street, Toledo, Ohio, which may be placed in the basement of a building and will keep the person tending the furnaces and ventilators of a building informed of the existing temperature of each room without necessitating his presence in the room.

ELECTRIC LANTERN.—An electric lantern for exterior or interior use has been brought out by the Friedley-Voshardt Company, 733 South Halsted Street, Chicago.

MILK AND CREAM TESTER.—An electric milk and cream tester with capacities of eight, twelve and twenty-four bottles has been placed on the market by the Imperial Electrical Company, Union City, Ind.

SOLDERING MACHINE.—A jewelers' electric soldering machine controlled by a foot switch has been brought out by the Goodall Electric Manufacturing Company, Ogallala, Neb.

WASHING-MACHINE MOTOR.—The Emerson Electric Manufacturing Company, 2018 Washington Avenue, St. Louis, has placed on the market a ¼-hp., 110-volt, 60-cycle washing-machine motor.

TREATMENT OF TRANSFORMER AND SWITCH OILS.—The Sharpless Specialty Company, Twenty-third and Westmoreland Streets, Philadelphia, is getting out new bulletins describing the super-centrifugal treatment of transformer and switch oils for maintaining their dielectric strength, and also bulletins dealing with the continuous regeneration of Diesel engine lubricating oil and turbine oil.

CLOTHES DRIER.—A folding clothes drier, "Sunny Day," has been brought out by the E. W. Kriekard Company, Cedar Rapids, Iowa.

DEVICE FOR OPENING AND CLOSING DOORS.—The Allith-Prouty Company, Danville, Ill., is manufacturing an electrically operated device, "Electromatic," for opening and closing garage doors.

STORAGE BATTERY.—The Electric Storage Battery Company, Philadelphia, has developed a battery, known as type 1-KZR-5, for use with low-voltage tubes.

LIGHTING FIXTURE FOR HOSPITALS.—Edward Miller & Company, Meriden, Conn., have brought out a new "Duplex-A-Lite" lighting fixture, designed particularly for use in hospitals.

STARTING DEVICE FOR AUTOMOBILES.—The Kase Electric Company, Sherwood Building, Duluth, Minn., is manufacturing a cold-weather starting device for automobiles, known as "As-Ke-Fuemizer."

BATTERY CHARGER.—The Fansteel Products Company, Inc., North Chicago, Ill., has placed on the market a new "Balkite" battery charger.

LIGHTING EQUIPMENT.—The Benjamin Electric Manufacturing Company, Chicago, has placed on the market an interchangeable equipment for industrial lighting units, known as "Ben-ox."

COMMERCIAL LIGHTING FIXTURE.—A new commercial lighting fixture, "Focalite," has been developed by the Moe-Bridges Company, Milwaukee.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

NEWPORT, N. H.—At an election held recently the proposal to establish an electric light service in the village was carried.

WAKEFIELD, MASS.—Plans have been filed by the municipal lighting department for the construction of a new substation to cost about $25,000.

NEW BRITAIN, CONN.—Plans are being prepared for the construction of a one-story power and machine building, 60 ft. x 160 ft., at the works of the Donnelly Brick Company. Max J. Unkelbach, New Britain, is architect.

Middle Atlantic States

AKRON, N. Y.—Plans are under consideration for the installation of electrically operated pumping machinery at the waterworks.

GROVELAND, N. Y.—The Livingston-Niagara Power Company has secured a franchise and will install a local lighting system.

LEWISTON, N. Y.—The Niagara, Lockport & Ontario Power Company has been granted permission to take over the property of the Niagara River Power & Water Supply Company and plans to erect a substation here.

MEDFORD STATION, N. Y.—The Great Eastern Sugar Company contemplates building a power plant and mill, to cost about $1,500,000. K. Grunwald is in charge.

NEWARK, N. J.—Electric power equipment will be installed by the Port Newark Brick Company at its proposed plant at Port Newark.

BLAIRSVILLE, PA.—Electric power equipment will be installed in the new local plant to be erected by the National Plate Glass Works, to cost about $3,000,000.

CARLISLE, PA.—The Cumberland Valley Light & Power Company is negotiating for the purchase of the property of the Cumberland Paradise Light & Power Company and plans to merge with its system.

DUBOIS, PA.—The installation of an ornamental lighting system in the business section is under consideration.

HAWLEY, PA.—The Pennsylvania Power & Light Company, Allentown, plans to build a hydro-electric plant on Wallenpaupack Creek, near Hawley, where an artificial lake will be formed with a power dam at Wilsonville. The project, with transmission system, will cost about $8,000,000. The company has purchased property in the Upper Perkiomen Valley section and plans to extend its transmission line there.

PHILADELPHIA, PA.—An electrical instrument and dynamometer department will be established in the laboratory now in course of construction at the local naval aircraft station, League Island, by the Bureau of Yards and Docks, Washington, D. C.

PITTSBURGH, PA.—The West Penn Power Company has received permission to erect a transmission line in Plum Township.

TELFORD, PA.—The Telford Power & Light Company is being organized as a subsidiary of the Pennsylvania Power & Light Company to install and operate a local system.

TROY, PA.—The Troy Township Electric Company, recently organized, plans to erect a transmission line. William S. Montgomery is treasurer.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company plans additions to its electric plant on Gould Street to triple the present capacity. New equipment, including two 20,000-kw. turbo-generators, with auxiliary equipment, will be installed. The total cost is estimated at $3,500,000.

PORT DEPOSIT, MD.—The Port Deposit Quarry Company, recently formed, contemplates the installation of electric power and mechanical equipment at its local plant.

WEST GRAHAM, W. VA.—Plans for the proposed local furniture manufacturing plant to be erected by R. E. Baldwin and K. B. Thomas include a power house.

WESTON, W. VA.—The installation of a new lighting system on the principal streets is under consideration. Andrew Edminston, Jr, is head of the committee in charge.

CHARLOTTESVILLE, VA—The installation of electrically operated pumps at the proposed municipal waterworks, to cost about $500,000, is under consideration. Fuller & McClintock, 600 Walnut Street, Kansas City, Mo., are engineers.

WASHINGTON, D. C.—Bids will be received by the general purchasing officer, Panama Canal, until Nov. 5, for one electric lighting outfit. (Circular 1566.)

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Oct. 30, for wireless equipment, including one motor-generator one keyboard perforator, one transmitter, 1,500 lb. of perforated tape, one signal recorder, 1,000 rolls of recorder tape, and one radio relay. Circular CP-16003-1.)

WASHINGTON, D. C.—Bids will be received by the Chief of Engineers, United States Army, Munitions Building, until Nov. 16, for water-tight lighting fixtures, including 400 ceiling-lamp fixtures, 200 wall-lamp fixtures, 75 portable hand lamps, 10 switch panel boxes, 500 glass globes, 6 gross screws and 25 snap switch handles (Advertisement 24-122); also for 2,000 ft. controller cable, nine-conductor, and 4,500 ft. controller cable, with reels. (Advertisement 24-121.)

North Central States

EDENVILLE, MICH.—The Wolverine Power Company has issued $1,570,000 in bonds to provide funds for the completion of four hydro-electric plants at Edenville, Smallwood, Sanford and Secords, with total output of 15,000 hp. Work is in progress on a substation at Edenville, and transmission system extension from Zilwaukee to Edenville, to cost about $800,000, under the direction of the Consumers' Power Company, which will take the entire output of the Wolverine company.

PORT HURON, MICH.—The Dunn Sulphite & Paper Company plans to build a power house at its proposed local mill, to cost about $500,000.

AKRON, OHIO—The People's Hospital Company plans to build a power house in connection with a number of new units at the institution on Cedar Street, to cost about $200,000. George J. Ball, Metropolitan Building, is architect.

BURGHILL, OHIO—Steps have been taken by local residents to secure electric lighting service for this district. E. O. Fitch is a member of the committee.

COLUMBUS, OHIO.—The Security Storage & Power Company, recently incorporated, has purchase the four-story building at 460 Dublin Avenue, and plans to convert it into a power building to accommodate a number of small manufacturing concerns.

ST. CLAIRSVILLE, OHIO.—The American Zinc & Chemical Company will install electric power equipment at its plant in connection with an addition, to cost about $200,000.

WILMINGTON, OHIO. — The Clayton Power & Light Company plans to install electrically operated pumps in connection with new local waterworks, to cost about $75,000.

AUGUSTA, KY.—The Kentucky Power Company is building a new power plant at Augusta, to supply electricity throughout this district.

HISEVILLE, KY.—The Hiseville Light & Power Company, recently organized, plans to erect a 2-mile transmission line.

WHITE PLAINS, KY.—The Kentucky Utilities Company has closed a contract for service with the White Plains Light & Power Company and will extend its transmission line here. Work will also commence on a new substation at Russellville for municipal service.

HUNTINGTON, IND.—The Northern Indiana Power Company, Kokomo, is negotiating for the purchase of the properties of the Huntington Light & Fuel Company and the Bippus Utilities Company, North Manchester. Bonds for $1,360,000 will be issued to finance the project and for extensions, including the erection of a transmission line to Huntington and vicinity.

LAFAYETTE, IND.—Bids will soon be called by the board of trustees, Purdue University, for the construction of the proposed electrical building at the institution, to cost about $100,000, with equipment.

HOBBS, IND.—The power house and canning factory of Frazier & Norris were recently damaged by fire, causing a loss of about $60,000.

MOMENCE, ILL. — The Public Service Company of Northern Illinois plans to erect a transmission line from Kankakee to Momence.

CUBA CITY, WIS.—Improvements will be made to the street-lighting system, including the installation of cluster lamps in the business district. Bonds to the amount of $15,000 have been approved for this purpose.

JIM FALLS, WIS.—The installation of a street-lighting system in Jim Falls, electricity to be furnished by the Wisconsin-Minnesota Light & Power Company, is under consideration by the local commercial association. A. L. Putnam is secretary.

MADISON, WIS.—A new power plant, equipped with oil engines, will be erected at the Madison Sanitarium, to cost about $15,000.

MARIENETTE, WIS.—The Pike River Granite Company contemplates equipping its Middle Inlet Quarry for electrical operation, at a cost of about $20,000.

MENESHA, WIS.—Extensions are contemplated to the municipal electric light and water plant, including an addition to the power house and the installation of an engine. Bids, it is understood, will be received by the city clerk for a 600-hp. oil engine.

MILWAUKEE, WIS.—A permit has been granted to the Pittsburgh Plate Glass Company to erect a power house on Oregon Street, to cost about $65,000.

ST. CROIX FALLS, WIS.—The St. Croix Falls Development Company, a subsidiary of the Northern States Power Company, plans to build a dam at Kettle River in connection with a hydro-electric development.

SHEBOYGAN, WIS.—The Eastern Wisconsin Electric Company is considering the development of additional power at Battle Island, on the Wolf River, near Elcho.

SHEBOYGAN, WIS.—The Eastern Wisconsin Electric Company has disposed of a bond issue of $1,150,000, part of the proceeds to be used for extensions and improvements.

SUPERIOR, WIS.—The City Council has authorized the installation of additional street lamps on Superior Avenue.

WAUSAU, WIS.—The Underwood Veneer Company plans to build a steam-driven electric plant to furnish electricity to operate its proposed new sawmill.

WAUTOMA, WIS. — The White River Power Company, recently incorporated with a capital stock of $100,000, contemplates the construction of a hydro-electric plant. When completed it will be connected with the local plant of the company, which will supply electric service in the villages of Coloma, Hancock, Plainfield, Almond and Wautoma. Messrs. Dahlke, Giese and Walker are the incorporators.

WHITEWATER, WIS. — Arrangements have been made by the Whitewater Electric Light & Power Company for extending its transmission line to Lauderdale Lake to furnish electrical service there.

MINNEAPOLIS, MINN.—The Northern States Power Company has acquired a power site on the St. Anthony River from the Pillsbury Flour Mills Company for a proposed hydro-electric development.

MINNEAPOLIS, MINN.—The Board of County Commissioners is considering plans for a county highway lighting system, with initial installation to be made on the Minnetonka Boulevard, from the city limits to Lake Minnetonka.

FARMINGTON, IOWA.—The Iowa Electric Company, Cedar Rapids, has acquired the municipal electric plant, and will extend its transmission system here.

HARRIS, IOWA.—An election will be held on Nov. 15 to vote on the proposal to sell the municipal electric system and to grant a franchise to private parties to operate an electric system here. A similar proposal will be submitted to the voters at Lake Park. John A. Reed, Cedar Rapids, and D. M. Sterns, Humboldt, are negotiating for the purchase of these properties. An option on the electric system at Ocheyedan is reported to have been secured by the above parties.

MARSHALLTOWN, IOWA.—J. O. Bisset has applied to the County Commissioners for permission to erect a transmission line in a certain section of the county.

WYOMING, IOWA.—The construction of a municipal electric light plant, to cost about $35,000, is under consideration.

CASSVILLE, MO.—M. L. Hardy, Maplewood, plans to build a power house at his proposed local lumber mill.

FLAT RIVER, MO.—The Federal Lead Company plans to rebuild its electric power plant, recently damaged by fire, with loss of about $20,000.

DEVILS LAKE, N. D.—The State Board of Administration, Bismarck, has rejected bids for extensions to the power plant at the local State School for Deaf. New bids, it is understood, will be called for at an early date. Shannon, Boyd & Boyd, Devils Lake, are architects.

FARGO, N. D. — The Great Northern Railway Company contemplates building a power house here.

MINOT, N. D.—The establishment of a municipal electric plant in Minot is under consideration by the City Commission.

WASHBURN, N. D.—The Central Light & Power Company plans extensions in its transmission system, including the rebuilding of the present line to McClusky.

CASTLEWOOD, S. D.—Bonds to the amount of $10,000 have been authorized for the construction of a transmission line, substation and a new distribution system in Castlewood.

SIOUX FALLS, S. D.—The Minnesota Electrical Distributing Company, Minneapolis, plans to erect a transmission line in Valley Springs Township and in other parts of Minnehaha County.

WHITE RIVER, S. D.—Plans are being prepared for a municipal hydro-electric plant on the White River, with distributing system. J. C. Jacobson, 1624 Harmon Place, Minneapolis, is engineer.

HASTINGS, NEB.—The purchase of a 400-hp. boiler for the municipal light and water plant is under consideration.

FREDONIA, KAN.—The Kansas Gas & Electric Company, it is understood, will soon ask for bids for the erection of a 60,000-volt transmission line from Fredonia to Cherryvale and also to build substations at Fredonia and Buffville. The cost of the work is estimated at $100,000. K. P. Horine, Fredonia, is in charge.

KANSAS CITY, KAN.—Bids will be received by Howard Payne, city clerk, until Oct. 30, for one 12,500-kva. turbo-generator, two 600-hp. watertube boilers and two sixretort underfeed stokers, for the municipal plant.

Southern States

ALBEMARLE, N. C.—The installation of electrically operated pumps in connection with extensions in the waterworks, to cost about $90,000, is under consideration.

WALNUT COVE, N. C.—A contract, it is understood, will soon be awarded for construction of a municipal hydro-electric plant on the Dan River.

CAMDEN, S. C.—Investigations are being made by the Yadkin Power Company, Raleigh, N. C., with a view of erecting a rural transmission line from Camden through the villages of Rambert and Hagood, to supply electricity to these villages and to farmers along the lines.

SENECA, S. C.—The installation of an ornamental lighting system on principal streets in the business district is under consideration by the Board of Public Works.

COLUMBUS, GA.—The Columbus Electric & Power Company plans extensions and improvements in its system, to cost about $110,000, including an underground conduit system in the business section.

MACON, GA.—The Schuster-Adams Company, recently organized, contemplates the construction of a power house at its proposed local chemical plant, to cost about $250,000. Hoke Smith is interested in the company.

BLOUNSTOWN, FLA.—Plans are being prepared for the installation of a municipal electric lighting plant, and electrically operated pumps at the waterworks, for which $50,000 in bonds have been voted.

FROSTPROOF, FLA.—Plans are under consideration for the installation of electrically operated pumps in connection with a new waterworks system, to cost about $100,000.

JACKSONVILLE, FLA.—An addition to the municipal electric plant, to cost about $51,300, and the erection of a substation are under consideration.

MIAMI, FLA.—The East Coast Improvement Company is considering the installation of an isolated electric plant on a tract now being developed. A. T. Barkdull is president.

BIRMINGHAM, ALA.—The Public Service Commission has granted the Alabama Power Company permission to issue $4,000,000 in bonds, the proceeds to be used for new construction work, additions and improvements.

MOBILE, ALA.—The installation of an ornamental lighting system in the business district is under consideration.

GULFPORT, MISS.—The installation of an ornamental lighting system in the business district is under consideration by the City Commission.

BAUXITE, ARK.—The American Bauxite Company plans to install electric power equipment in connection with plant extensions and improvements to cost about $150,000.

MORRILLTON, ARK. — The Arkansas Light & Power Company contemplates building a new local plant, to cost about $35,000.

BOGALUSA, LA. — The Union Bag & Paper Corporation, Woolworth Building, New York, contemplates building a power house at its proposed local plant, to cost about $500,000.

MONROE, LA.—The Sweet Glass Company plans to install a substation and electric power equipment at its proposed local plant, to cost about $85,000.

WASHINGTON, LA.—All bids submitted for the municipal electric plant have been rejected. Plans, it is understood, will be revised before new bids are called for.

WELSH, LA.—Bids will soon be asked for the construction of an addition to the municipal electric plant, for which $20,000 in bonds have been voted. John T. Smith is engineer.

COWETA, OKLA.—The Public Service Company of Oklahoma, Tulsa, plans to erect a high-tension transmission line from Broken Arrow to Coweta, via the Evans coal mines. The company has been granted a franchise in Coweta.

DALLAS, TEX.—The Dallas Power & Light Company is planning extensions to its underground system during the coming year, to cost about $200,000.

FORT WORTH, TEX.—The Southwestern Portland Cement Company, El Paso, plans to build a power house at its proposed local plant.

MARSHALL, TEX.—The installation of electrically operated pumps in connection with new municipal waterworks, to cost $80,000, is under consideration.

SAN BENITO, TEX.—The Valley Electric & Ice Company contemplates building a new electric plant here for service in the Rio Grande Valley section, where the transmission system will be extended.

SANGER, TEX. — The city has taken over the plant of the Sanger Light & Power Company and will make improvements to same.

TYLER, TEX.—The Texas Power & Light Company plans to erect about 200 miles of transmission lines, including a line to Palestine with branches, a line in the Powell oilfield and a 60,000-volt line from Hillsboro to Corsicana. The total cost is estimated at $1,000,000.

Pacific and Mountain States

SEATTLE, WASH.—The sale of $1,000,000 in bonds has been authorized, the proceeds to be used for the municipal light and power department.

TACOMA, WASH. — An ordinance has been adopted by the City Council providing for the installation of ornamental lamps on a portion of South Tacoma Avenue and a number of other streets in that section.

TACOMA, WASH.—Bids for the first unit of the Lake Cushman power project, it is stated, will be called in about sixty days. Estimates on generating machinery, etc., are being made, preparatory to naming the total amount needed in the bond issue. Ira S. Davisson is commissioner.

YAKIMA, WASH. — The City Commissioners have adopted an ordinance providing for the installation of ornamental lamps on twenty-seven blocks in the business district, to cost about $25,000.

OREGON CITY, ORE. — The Hawley Pulp & Paper Company plans to install electric power equipment in connection with the rebuilding of its local mill recently damaged by fire with loss of about $600,000.

LOS ANGELES, CAL. — The Board of County Supervisors is considering the installation of an ornamental lighting system for County Road Improvement District No. 50, using reinforced-concrete standards.

LOS ANGELES, CAL.—The installation of an ornamental lighting system on Washington Boulevard, consisting of 130 standards, to cost about $41,000, is under consideration.

LOS ANGELES, CAL.—The Weber Showcase Company, 316 South Los Angeles Street, plans to build a power plant at its proposed new factory at South Park and Slauson Avenues, to cost about $500,000.

LOS ANGELES, CAL.—Plans for the proposed plant to be erected by the Crescent Creamery Company on Slauson Avenue, to cost $115,000, include a power house and an electric traveling crane. Morgan, Walls & Morgan, Van Nuys Building, are architects.

SAN LUIS OBISPO, CAL.—Bids will be received by the County Clerk until Nov. 5 for equipment for the San Miguel Lighting District and for maintenance of same.

SAN MATEO, CAL.—The installation of a fire-alarm system, including underground lines in the business section and overhead system in residential portion, to cost about $30,000, is under consideration. G. Stanley Whitehead is city engineer.

SANTA BARBARA, CAL.—The County Supervisors have authorized plans for a hydro-electric plant and irrigation system in the Santa Maria Valley. The project includes a dam on the Sisquoc River. The cost is estimated at $3,500,000.

TORRANCE, CAL. — A special election will be called to vote on a bond issue of $75,000 for street lighting and $175,000 in bonds for the purchase of a water system.

UPLAND, CAL.—Plans are under consideration for the installation of electrically operated pumping machinery in connection with new municipal waterworks.

PHOENIX, ARIZ.—Application has been filed with the State Water Commissioner by the Arizona Highline Reclamation Association for water and power sites for the proposed irrigation of 3,500,000 acres of land. The plans include the construction of a dam below Spencer Canyon about 150 ft. high and the development of 750,000 hp.

Canada

VANCOUVER, B. C. — The Maitland Portland Cement Company plans to build a power plant at its proposed local mill, to cost about $500,000.

PETERBOROUGH, ONT. — The Hydro-Electric Power Commission of Ontario has applied for permission to erect a 44,000-volt transmission line from the Auburn power station to the new municipal distributing station at the corner of Sherbrook and Aylmer Streets.

Electrical Patents

Announced by U. S. Patent Office

(Issued Oct. 9, 1923)

15,697 (reissue). METER; R. F. Schuchardt Chicago, Ill. App. filed Nov. 29, 1918. Indicating power-factor meter.

1,469,779. AUTOMATIC TELEPHONE DIAL SUPPORT; A. J. Curren, Elyria, Ohio. App. filed Oct. 20, 1919. For wall telephones.

1,469,784. TROLLEY WHEEL; R. W. Funk, Bellefonte, Pa. App. filed Aug. 10, 1921. Contact wheel for trolley wire.

1,469,794. TELEPHONE SYSTEM; L. D. Kellogg, Deerfield, Ill. App. filed Feb. 17, 1919. Automatic switches employed for completing connections.

1,469,807. AUTOMATIC TELEPHONE SYSTEM; R. G. Richardson, Chicago, Ill. App. filed Jan. 8, 1917. Full automatic system.

1,469,809. AUTOMATIC TELEPHONE SYSTEM; A. J. Ray, Chicago, and H. F. Obergfell, Austin, Ill. App. filed Sept. 20, 1920. Automatic party-line selective ringing system.

1,469,817. METHOD OF ELECTRICALLY MELTING METALS AND IN AN ELECTRIC FURNACE; I. Rennerfelt, Djursholm, Sweden. App. filed June 16, 1921. Method of melting iron and steel.

1,469,832. SELECTIVE CIRCUITS FOR MULTIPLEX SIGNALING; B. P. Hamilton, Brooklyn, N. Y. App. filed Sept. 23, 1919. Maintaining channels of multiplex system electrically separate.

1,469,847. AUTOMATIC TELEPHONE SYSTEM; W. W. Owen, Oak Park, Ill. App. filed May 20, 1918. Automatic switching.

1,469,869. CARRIER TRANSMISSION ROUTING ARRANGEMENT; H. A. Affel, Brooklyn, N. Y. App. filed July 24, 1919.

1,469,887. ELECTRIC ALARM CLOCK; E. N. Burleigh, Pittsburgh, Pa. App. filed Nov. 18, 1922. Sounds alarm at predetermined hour and lights electric lamp.

1,469,889. RECEIVING SYSTEM FOR RADIANT ENERGY; E. L. Chaffee, Belmont, Mass. App. filed April 25, 1918.

1,469,905. CIRCUIT-CONTROLLING MEANS; R. E. Hall, Chicago, Ill. App. filed Aug. 13, 1919. By means of a resistance element.

1,469,912. CIGAR OR CIGARETTE LIGHTER; A. Barna, Jr., Chicago, Ill. App. filed April 14, 1922. For use in motor vehicles.

1,469,913. PUSH PLUG FOR ELECTRIC SOCKETS; J. Blackburn, St. Louis, Mo. App. filed Dec. 20, 1920.

1,469,941. RECEIVER SUPPORT FOR SOUND AMPLIFIERS; C. W. Kuen, Chicago, Ill. App. filed May 1, 1922. Device for attaching radio receivers to phonograph or loud speaker.

1,469,989. LINEMAN'S GUARD; H. B. Bush, Bedford, Ohio. App. filed Aug. 16, 1920. Wooden guard to prevent lineman from coming in contact with energized lines.

1,470,027. METHOD AND APPARATUS FOR ABSORBING RADIUM EMANATION; H. B. Palmer, Morristown, N. J. App. filed March 9, 1920.

1,470,035. TELEPHONE-EXCHANGE SYSTEM; F. J. Scudder, Long Island, N. Y. App. filed March 31, 1921. Mechanical switching devices.

1,470,043. RAILWAY CROSSING SIGNAL; C. Adler, Jr., Baltimore, Md. App. filed Sept. 29, 1920. Electrically operated.

1,470,047. ELECTRIC SADIRON; S. T. Arnold, Paducah, Ky. App. filed April 25, 1921. Thermostatic switch or control device to prevent overheating.

1,470,062. COMBINED BELL AND BUZZER; J. W. Cox, Baraboo, Wis. App. filed June 25, 1921. Two vibrating armatures.

1,470,088. ART OF WIRELESS COMMUNICATION; F. Lowenstein, New York, N. Y. App. filed Nov. 29, 1918. Transmission and reception of signals by sinusoidal alternating-current impulses of relatively low frequency.

1,470,092. MAGNETO ELECTRIC MACHINE; G. Modigliani, Ivrea, Italy. App. filed June 11, 1919. For internal-combustion engines.

1,470,093. MAGNETO ELECTRIC MACHINE; G. Modigliani, Ivrea, Italy. App. filed Dec. 23, 1919. For internal-combustion engines.

1,470,127. VEHICLE SIGNAL; H. F. Taylor, Jr., Buffalo, N. Y. App. filed Jan. 2, 1920. Rear direction signal.

1,470,135. LAMP; J. H. Ballweg, Portland, Ore. App. filed Aug. 17, 1921. Small searchlight.

1,470,160. CHAIN-LINK WELDING; J. H. Gravell, Elkins Park, Pa. App. filed June 3, 1921. By high-amperage current with suitable forming dies.

1,470,195. ELECTRIC FURNACE; M. de Roiboul, Paris, France. App. filed Sept. 28, 1920. Method of fusing refractory metals.

1,470,202. SELECTOR RACK FOR AUTOMATIC TELEPHONE SYSTEMS; A. E. Stevens, Providence, R. I. App. filed Aug. 2, 1921.

1,470,214. ALTERNATING-CURRENT TRANSFORMER; J. R. Brueckner, Detroit, Mich. App. filed Aug. 23, 1920. For welding systems.

1,470,227. LIGHTING UNIT; M. Klein, New York, N. Y. App. filed Aug. 19, 1920. Semi-direct unit.

1,470,238. REPEATER SYSTEM; R. C. Mathes, New York, N. Y. App. filed April 26, 1918. For amplifying telephone currents.

1,470,300. PROCESS OF GRAPHITIZING PREFORMED CARBON BODIES; E. Szarvasy, Budapest, Hungary. App. filed June 3, 1920. Graphitizing electrodes in atmosphere of methane.

1,470,322. WIRELESS TIE INSULATOR; H. A. Frederick, Chicora, Pa. App. filed Nov. 18, 1919. Communication-line insulator with means for fastening wire thereto.

1,470,337. TERMINAL CONNECTOR FOR ELECTRICAL WINDINGS; C. H. Thordarson, Chicago, Ill. App. filed Jan. 30, 1922. Means for strengthening the winding structure.

1,470,389. RADIO PILOT-CABLE SYSTEM; L. Rellstab, Zeist, Netherlands. App. filed Aug. 23, 1921. For steamships.

1,470,406. SIGNALING DEVICE; F. B. Watkins, Los Angeles, Cal. App. filed Jan. 4, 1921. Rear direction signal for automobiles.

1,470,428. COMMUTATION OF DYNAMO-ELECTRIC MACHINES; J. W. Dorsey, Winnipeg, Manitoba, Canada. App. filed Feb. 14, 1920. Prevention of sparking or arcing on high-voltage direct current machines.

1,470,430. TELEPHONE AMPLIFIER SYSTEM; M. C. Ellison, Huttons, England. App. filed Oct. 16, 1922. For mine systems.

1,470,432. LANTERN; W. T. Evans, Mitchell Neb. App. filed May 15, 1922. Battery lamp for strapping to chest, leaving hands free.